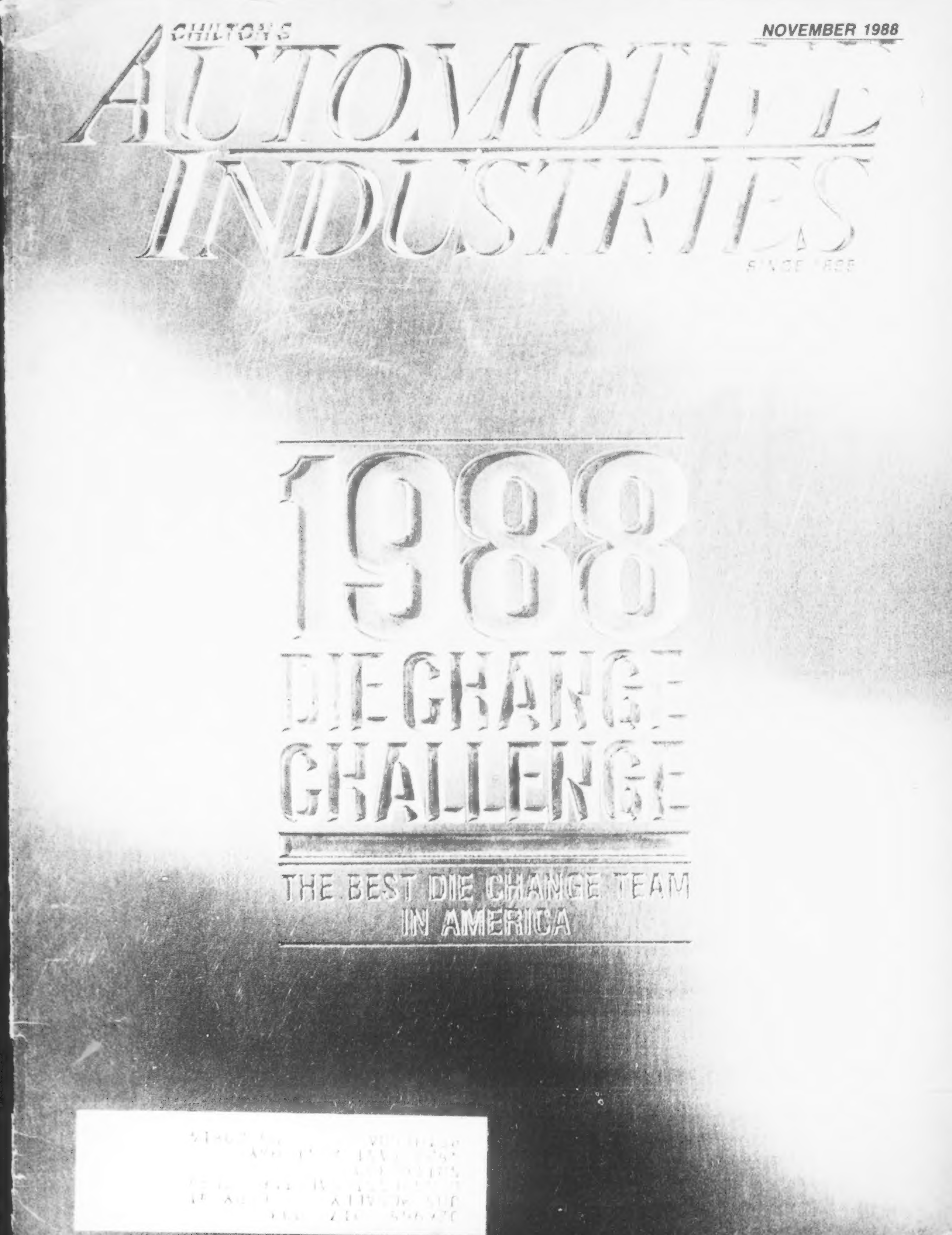

NOVEMBER 1988

CHILTON'S AUTOMOTIVE INDUSTRIES

SINCE 1895

1988 DIE CHANGE CHALLENGE

THE BEST DIE CHANGE TEAM IN AMERICA

NOVEMBER 1988 VOLUME 168, No.11

CHILTON'S
AUTOMOTIVE INDUSTRIES
SINCE 1895

For the third year in a row, AI pits the industry's best stamping plants against each other – and against our stopwatches – in the annual Die Change Challenge. As the number of participants increases, so does their QDC efficiency. Story begins on p.52.

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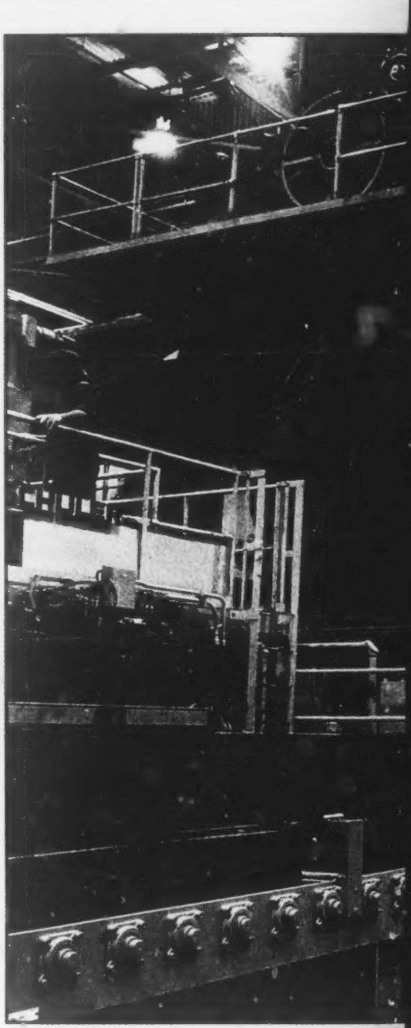
CHILTON COMPANY, *PART OF CAPITAL CITIES/ABC, INC.*

DIE CHANGE CHALLENGE '88

Our search for the Best Die Change Team shows that competition improves the industry.

By JOHN McELROY



There's a man standing at the end of a noisy line of stamping presses. In one hand the man has a stopwatch, in the other a bullhorn. As a stamped steel door panel appears on the conveyor that's moving towards him, he keeps his eyes glued to the stopwatch and raises the bullhorn to his lips.

"Fifty-five, fifty-six, fifty-seven," he calls out over the constant *ka-chunk, ka-chunk, ka-chunk* of the press line at GM's Grand Blanc, MI stamping plant. The crowd of workers surging around him are totally absorbed by the excitement of the moment. Jostling for a better view of the panel coming down the conveyor, a spontaneous chant goes up: "Go, go, *go*!"

As the panel emerges from the last press, the man with the bullhorn clicks his watch to a stop. "4:59!" he yells. Pandemonium breaks out – fists are thrust elatedly into the air. High-fives slap at every open hand. One worker runs through the plant, bellowing "Awwwwriiiight!"

No wonder they're elated. They've just changed the dies on this line of stamping presses in less than five minutes. A year ago it would've taken them 12 hours. And no, they haven't installed robots or computers or automation to make this incredible improvement. They did it the old fashioned way, with organization and teamwork.

Not only have these "Rust Belt" union workers proved to themselves that they can be world-class, they're making their plant competitive again, and in the process they've probably saved their jobs.

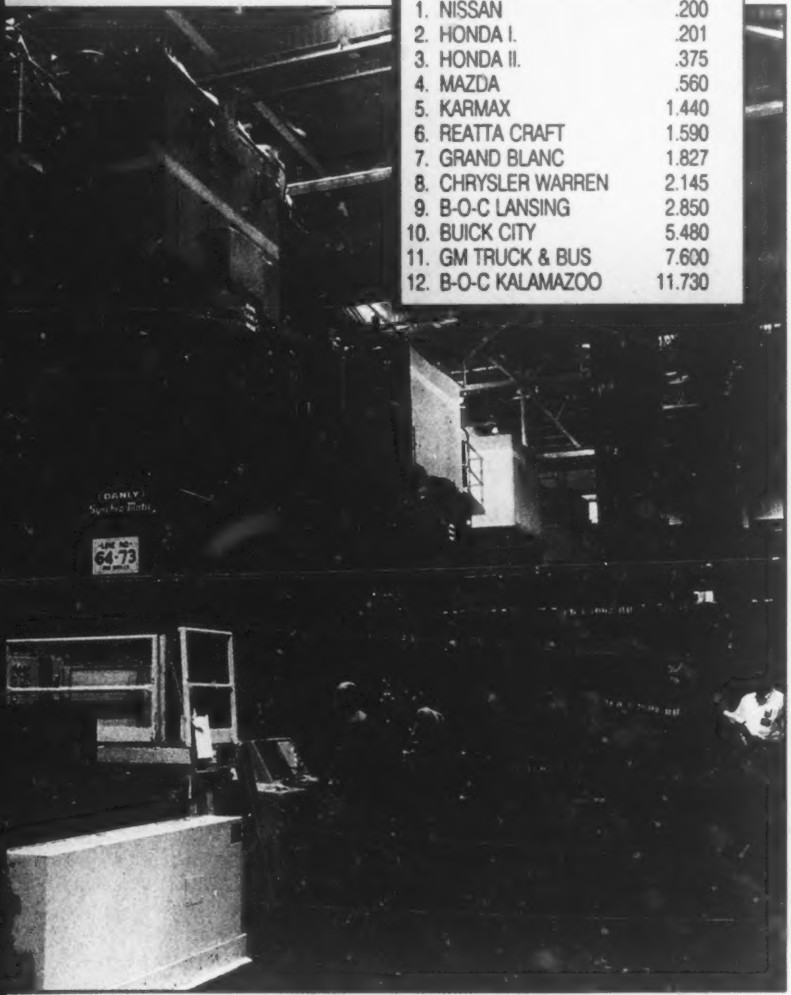
"It was by doing all the simple things and by using a little team work that we got all this accomplished," notes Jerry Leman, Grand Blanc's plant manager. "The bottom line is people working together."

The Die Change Challenge

Three years ago we at *AI* recognized that some truly spectacular improvements were starting to take place in the American automotive industry, especially on the factory floor. Not only did we want to bring attention to what was happening, we wanted to help accelerate this change. And what better way to make people compete than to organize a competitive event? Ergo,

PRODUCTIVITY COMPARISON
Factor in the number of people used, the time it took them to change dies, and it's easy to see who's the most productive.

	COMPANY	MAN-HOURS/ DIE CHANGE
1.	NISSAN	.200
2.	HONDA I.	.201
3.	HONDA II.	.375
4.	MAZDA	.560
5.	KARMAX	1.440
6.	REATTA CRAFT	1.590
7.	GRAND BLANC	1.827
8.	CHRYSLER WARREN	2.145
9.	B-O-C LANSING	2.850
10.	BUICK CITY	5.480
11.	GM TRUCK & BUS	7.600
12.	B-O-C KALAMAZOO	11.730



An industrial Godzilla: The four-press stamping line at GM Truck & Bus's Indianapolis plant.

the Die Change Challenge.

We invited every automaker with operations in the US – including the Japanese – to take part. But in 1986, only four plants took up the challenge. That didn't surprise us; we recognized that quick die change (QDC) was still in the development phase in the US.

But sure enough, last year two more plants competed and this year the field increased to 12 QDC teams.

But these teams are very much the exceptions to the rule. In the US automotive industry, a typical die change – which involves taking the dies that are making, let's say doors, and changing them with dies that will make, say fenders – still takes anywhere from six to 10 *hours*. In Japan a typical die change takes five to 10 *minutes*.

This astounding difference documents one of the many areas where Japanese automakers still hold a competitive advantage over their American counterparts. But recently the American auto industry has awakened to the advantage QDC offers.

"We calculated that every minute saved on a die change, spread over a year's time, will save us about $25,000," says Tom Dull, supervisor of manufacturing at GM's Truck & Bus plant in Indianapolis.

Changing Dies The Old Way

It's not that the Big Three have been totally in the dark. It's just that traditionally, there wasn't a pressing need for quick die changes.

For one thing, the American automakers used to make fewer kinds of cars than they do today. In the old days, when Chevy changed dies to make different parts (which was rare), it always did so on the midnight shift and took up to eight hours to do so. But with the proliferation of models that exists today, no one can afford that many press lines.

In Japan, a different set of circumstances led the automakers there to develop a different manufacturing philosophy. In the '50s, Japan was still struggling to get back on its feet, and investment capital was hard to come by. The Japanese car companies literally couldn't afford to buy extra press lines (which now cost $15 million) and dedicate them to make specific parts. They needed the flexibility to make many parts on each press line, and quick die change gave them that flexibility. In addition, it also allowed them to make smaller lot sizes which fit into their just-in-time production system that operates with lower inventory.

It was only at the beginning of the 1980s that the US automotive industry began to discover just how far it had fallen behind the Japanese. A 1981 manufacturing comparison conducted by Harbour & Associates for the DOT sent shock waves through the industry. It showed the Japanese with a $1750 cost advantage for a subcompact car!

Many American auto executives scoffed in disbelief at such reports. But

DIE CHANGE CHALLENGE '88

they couldn't ignore the fact that millions of consumers clearly perceived Japanese cars were better. Something had to be done.

Slowly, things began to happen. At first, however, the Big Three tried to buy their way out of their problem. Efforts in the early 1980s centered on "high-tech" solutions such as robots, computers and other automation. But after several new plants sputtered to a stop when their new technology failed, it became apparent that this approach alone wouldn't work.

QUICK DIE CHANGE VS. SLOW DIE CHANGE

1. Production stops
2. Rams come down
3. Clamps come off dies
4. Rams go up
5. Bolsters slide out of presses
6. New bolsters slide in
7. Rams come down
8. Clamps go on dies
9. Automation changed (if needed)
10. Production resumes
11. Overhead crane takes dies to storage

TOTAL TIME: 5-10 MINS.

1. Production stops
2. Rams come down
3. Workers look for wrenches
4. Clamps come off dies
5. Rams go up
6. Bolsters slide out
7. Overhead crane takes die to storage
8. Break time: 10 min.
9. Die spotter looks for new dies in die storage room
10. Overhead crane brings new dies to the press line
11. Die setters start bolting dies to the bolsters
12. Lunch time: 30 min.
13. Bolsters slide into press
14. Ram height adjusted for new die
15. Workers look for other wrenches
16. Clamps go on dies
17. Automation is changed
18. 3-4 panels run through draw die; if not OK, call die repairmen
19. Break time: 10 min.
20. Run more panels, adjust dies and automation accordingly
21. Production resumes

TOTAL TIME: 6-10 HOURS

"A year ago this would've taken all day." —Ron Sumners, GM Truck & Bus.

GM Truck & Bus: Fully-automatic but a 30:40 QDC time.

"If they couldn't efficiently manage yesterday's technology, what made them think they could manage tomorrow's?" asks manufacturing consultant Jim Harbour.

Worker Input

The problem required a more basic approach. Now more effort was put into re-designing cars and components for greater ease of assembly. The entire manufacturing process was statistically analyzed to make sure it was capable of making quality parts. And, most importantly, the first genuine efforts were made to bring the hourly workforce into the planning process.

It's this last point that made quick die changes possible. A die change is a tightly choreographed performance, an industrial ballet. It involves moving dies that can weigh anywhere from 20,000 to 70,000 lb each, and moving them in and out of a press line in minutes. It calls for precision and perfection. A minute's delay means wasting thousands of dollars in lost production. Without the co-operation of the hourly workforce, QDC is impossible.

"The reason for our success came from two nice four-letter words: team work. It just shows what happens when everyone works together, because if you blinked, you missed it," notes Bill Smith, launch coordinator at Chrysler's Warren Stamping plant.

The ABC's Of QDC

A traditional die change is like having your car serviced at the local garage. By comparison, a quick die change is like making a pit stop in the Daytona 500. At the garage they'll try to figure out what's wrong with your car and maybe they'll have it fixed in a few days. But at Daytona, the pit crew has all its tools and parts right there and everyone in the crew knows exactly what to do: get the car back in the race as fast as possible. The same applies to changing stamping dies.

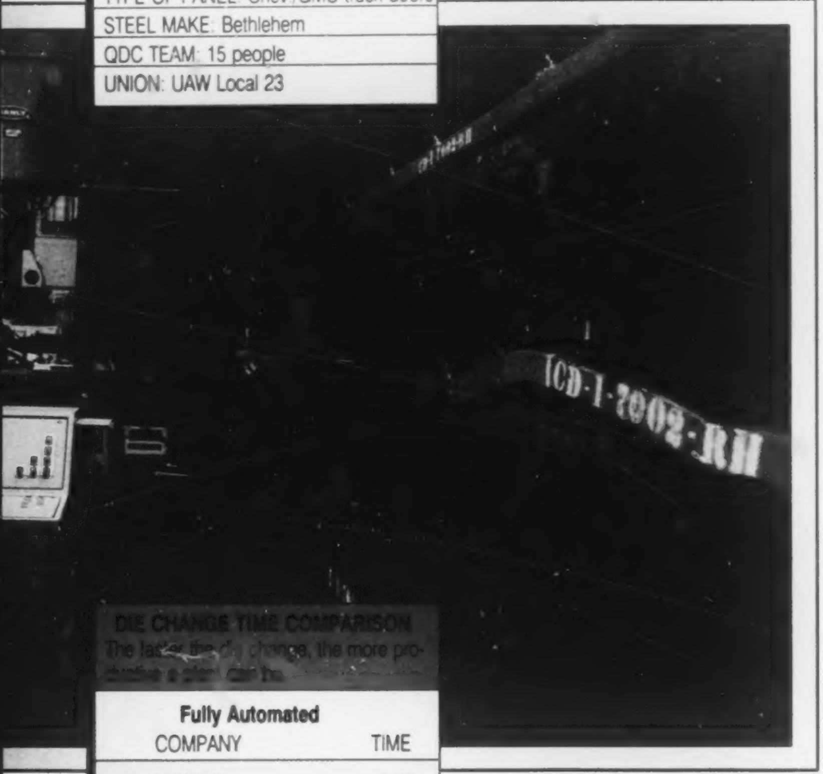
"When a press is sitting idle it's not making any parts. When it's not making any parts, we're not making any money," explains Mike Hottinger, a VP with Magna, the Canadian automotive supplier. Interestingly, Magna calculated that just by cutting a die change from three hours to one hour it could free up 1000 hours of extra production time. In fact, one of its plants increased sales by $4 million simply through the extra production time achieved from its QDC efforts. And Magna didn't spend a dime in new equipment for these improvements.

Though there's no doubt that new

GM TRUCK AND BUS Indianapolis, IN
CATEGORY: Fully-automated
NO. OF PRESSES: 5
MAKE OF PRESSES: Danly
TYPE OF PRESS: 800-, 600-ton tandems
AGE OF PRESS LINE: 9 yrs.
TYPE OF PANEL: Chev./GMC truck doors
STEEL MAKE: Bethlehem
QDC TEAM: 15 people
UNION: UAW Local 23

press lines are wonderful to have, it's possible to achieve world-class times with old equipment as well, even though it takes more people to do so. The key is to convert as much of the operation as possible to *external* set-up, so that the QDC team can be getting ready even while the press runs.

With external set-up, all the new dies are pre-staged next to the press. If wrenches are needed, they too are set at the ready. And the same goes for the automatic extractors that pull the stamped steel panels from the presses.



DIE CHANGE TIME COMPARISON

The faster the die change, the more productive a plant can be.

	Fully Automated COMPANY	TIME
1.	NISSAN	1:20
2.	MAZDA	5:40
3.	HONDA I.	6:03
4.	B-O-C LANSING	3:34
5.	GM TRUCK & BUS	30:40
	Semi Automated COMPANY	TIME
1.	HONDA II.	3:57
2.	REATTA CRAFT	9:33
3.	KARMAX (MAGNA)	9:39
4.	B-O-C BUICK CITY	18:16
	Manual COMPANY	TIME
1.	CHRYSLER WARREN	4:57
2.	GRAND BLANC	4:59
3.	B-O-C KALAMAZOO	32:00

Once everything is in place and ready to go, the line is stopped, and the workers start to "break down" the first press in the press line. Everyone has a specific job to do, and once the first press is changed, they move to the second one, and so on down the line. Obviously, teamwork is crucial.

"We'd practice a die set [change], come back in the meeting room, talk it over, find where we could do better. We worked on each person's movements and who was going to be where. Then we'd go out and do it all over again," explains Tom Posch, department manager of stamping at Nissan. "Brainstorming produced 90% of the improvements; physical changes only accounted for 10%."

The Rules

The Die Change Challenge takes the *AI* editorial staff on an 8000-mile whirlwind tour of the American Midwest, plus a two-day jaunt into Canada. It is a three week cram course in stamping operations that fills several notebooks and cassette tapes. And the process is punctuated by a blur of crowded airports, day-long rental car drives, and lots of coffee.

There are three QDC categories. Fully-automated presses are completely computer-controlled. The dies slide in on rolling bolsters and are clamped automatically. Semi-automated presses may have rolling bolsters and automatic clamps, but not both. And manual presses are just that – no automatic anything.

The way we time each die change goes like this: We start our stopwatches when the last panel comes out of the last press, and we stop them after the dies have been changed and the first good panel comes through.

But time alone doesn't dictate which team is the best. Manpower, cost and productivity is also factored in. And though we see who does the best in each category, we're still after the *overall* best.

Before we give the final results away, let's take a look at how each team performed.

Chrysler – Warren

Why is everyone at Chrysler's Warren Stamping smiling? We haven't started and already they're happy. This looks like it's going to be fun.

As we approach the press line, the mystery begins to unfold. Compared to those of some of the monster presses we've seen at other competitors, this line is positively dainty. Warren, a first-year entry in our QDC Challenge, has made the rules of the competition work in their favor. The Dodge van front fender they'll be stamping *is* an exterior body panel and it *is* a class A surface – the kind the customer can

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see and touch. Nobody said anything about size. Good thinking, Chrysler.

The troops are pumped. As the last panel moves through the presses, the operators pull aside the metal tables that are used to transfer parts from press to press. Suddenly, in a blur of motion, five forklifts draft each other down the aisle. When they reach the press line, they peel off in a manner reminiscent of the Blue Angels.

By the time the trucks reach the presses, the diesetters have loosened all the necessary hardware. The forklifts pull the dies from the press and in the only altercation of the day, two of them trade paint. Undaunted, the crowd behind us begins shouting words of encouragement as the trucks rush off for the new dies.

Only 2:00 have passed and the replacements are on their way. These guys are *smokin'*. While the trucks position the dies, we see clenched fists in the air. "*Come on!*" someone barks. One by one the forklifts dissappear and the operators shove the metal tables back into place. Here comes the first piece...4:57!

The floor becomes a zoo of hugging, celebrating, handshakes and high-fives. People are jumping up and down like a scene out of *Rocky*. In an attempt to get pictures, we're caught up in a wave of people.

"We're a family," beams one of the workers. "We might fight amongst each other, but we work together."

During our brief Q & A session that follows the die change, Bill Smith, launch coordinator states: "We developed techniques here that are going to help all of Chrysler stamping. We brought in 48 jobs (parts) in 18 months because of our run-to-run program." Quotes like that are music to our ears. That's what QDC is all about.—*Gerry Kobe*

GM Truck & Bus—Indy

As we're driving down I-69 into Indianapolis, the radio reports are assessing the effect of the drought on soybean prices and pork-belly futures. It would have been a good year, but the unexpected happened. The drought hit. But as the farmers know, when the unexpected hits, you just deal with it. The same goes for die changes. As we peer down one of these massive stamping lines at GM's Truck & Bus plant in Indianapolis, we get the feeling we're looking at a monstrous mechanical spider. And a noisy one at that. The rams all drop at once—*ka-chunk*—then lift up. The automatic arms reach in, pull out the panels, then stop. The rams come down again and the operation repeats.

But then the last panel spits out of the last press and everything stops. The die change is underway. Everyone works quietly and deliberately. At 2:00, the rolling bolsters are coming out, and the new ones are right behind them. As each new bolster comes into position, one man walks over to a control panel and starts pushing buttons and twisting knobs. He eases the ram into place, and when it's right where he wants it, he flips a few more switches. The dies are clamped into place.

At 5:00 everything is ready to go. But *no*—there's a problem! We're watching a control panel that is flashing a red light. An electrician comes over and hits a button. Some green lights come on. But the red light keeps flashing. He hits the button a few more times, but no luck.

No one panics or gets mad. But you can see the disappointment on their faces. They all look up at the overhead panel with the flashing red light and wait. Finally, it goes green. Somewhere amongst the wires, a plug had not been pushed in. The spider starts to work again: *Ka-chunk, ka-chunk.*

The inspector grabs the first panel as it comes off the line. It's good! But this die change took 30:00. They had hoped for 10:00.

Yet, they keep it all in perspective. "If you have been here a year ago this would've taken *all day*," says Ron Sumners, a press metalworker.—*John McElroy*

MANPOWER COMPARISON

The fewer the people needed to make a die change, the more efficient the operation is.

	COMPANY	NO. OF QDC PEOPLE
1.	HONDA I.	2
2.	MAZDA	6
3. (tie)	KARMAX	9
	NISSAN	9
5. (tie)	REATTA	10
	HONDA II.	10
7.	GM TRUCK & BUS	15
8.	BUICK CITY	18
9.	LANSING	20
10. (tie)	KALAMAZOO	22
	GRAND BLANC	22
12.	CHRYSLER WARREN	26

Karmax—Magna

We're thrilled when we find that Karmax has decided to enter the competition, because being on the outskirts of Toronto, it adds an international flavor to the Die Change Challenge. This is the first supplier to take part, but that doesn't surprise us. Karmax is part of the giant Canadian supplier, Magna, which is well known in the industry for many firsts.

The Karmax facility is an impressive new stamping plant that is kept spotlessly clean. The floor shines. The presses look like they're freshly painted. The dies are immaculate. The automation is pre-staged in neat rows. And unlike most new plants, there are a lot of windows in the plant.

"We don't want people coming into work thinking, 'Oh, I'm going in that black hole again,'" says Russ Peddle, the project manager.

Out on the floor there is an air of nervousness. When the signal for the die change comes through these guys really start to scurry. If we had to title this die change we'd call it "High Anxiety." No one is doing anything foolish – they just desperately want to do well.

And they've borrowed a concept from racing. Just as you might see a pit stop where the crew chief stands in front of the car until the stop is completed, then throws both hands in the air and steps back to signal the driver to get back in the race, the same idea is used here.

One guy in a red shirt moves up the line with the QDC team. As each press is "buttoned up" he throws his hands in the air, signaling the crew to move onto the next press. When his hands go up, the crew responds: "Go!" To the next press: "Go!" And so on up the line.

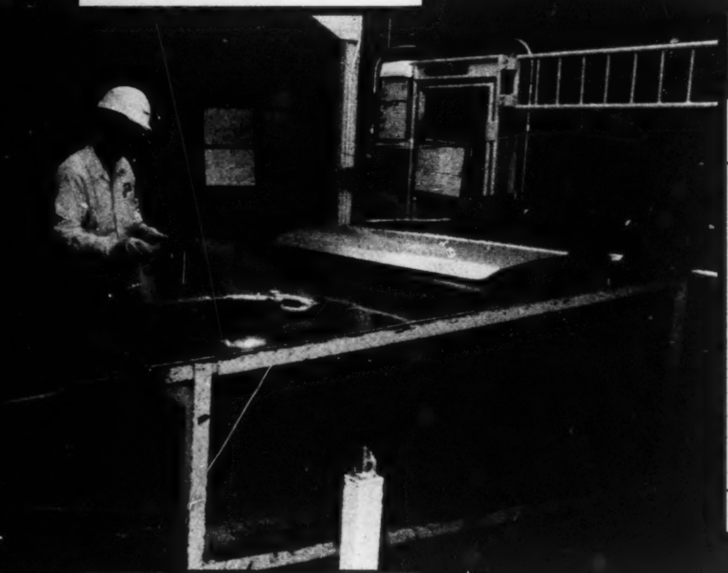
At 8:00, the first panel comes through the draw press. Several people follow the panel as it moves up the line, imploring it to move faster. "Come on, *come on*," they say. The panels certainly seem to move fast and the first one comes off in 9:39. It's a good time and the team is obviously happy.

Everyone on the die change team wears a gray shirt with their name on one side and a patch that says 20/20 on the other. The patch represents their goal to achieve a 20:00 die change average in the plant. So much for setting your goals too low.

"Maybe now we'll have to switch that to 10/10," jokes one worker. – *John McElroy*

HONDA
Marysville, OH

CATEGORY: Fully-automated
NO. OF PRESSES: 1
MAKE OF PRESS: Hitachi-Zosen
TYPE OF PRESS: 4700-ton transfer
AGE OF PRESS: 1 yr.
TYPE OF PANELS: Civic doors
STEEL MAKE: Bethlehem, Armco
QDC TEAM: 2 people



Mazda: Newcomer does a fully-automatic 5:40.

COST COMPARISON
The ultimate test of competitiveness is to see who can deliver at the lowest price.

	COMPANY	LABOR COST/ DIE CHANGE*
1.	NISSAN	$ 5.40
2.	HONDA I.	$ 5.42
3.	HONDA II.	$ 10.12
4.	MAZDA	$ 15.12
5.	KARMAX (MAGNA)	$ 39.00
6.	REATTA	$ 42.97
7.	B-O-C GRAND BLANC	$ 49.33
8.	CHRYSLER WARREN	$ 57.91
9.	B-O-C LANSING	$ 77.09
10.	BUICK CITY	$147.96
11.	GM TRUCK & BUS	$207.00
12.	B-O-C KALAMAZOO	$316.80

*Assumes a $27.00/hr. hourly wage.

MAZDA
Flat Rock, MI

CATEGORY: Fully-automated
NO. OF PRESSES: 1 (5 dies)
MAKE OF PRESS: Komatsu
TYPE OF PRESS: 3000-ton tri-ax.transfer
AGE OF PRESS LINE: 2 yrs.
TYPE OF PANEL: Ford Probe door
STEEL MAKE: Nippon
QDC TEAM: 6 people
UNION: UAW Local 3000

Nissan – Smyrna

At first glance, Nissan Smyrna doesn't seem like a stamping plant.

Entering the lobby of the building is like passing through the air lock of a space vehicle. Circular, sleek, and ceilingless. Are we really in a manufacturing plant?

Then, *boom*! Huge double doors give way to the underworld – towering presses, uniformed plant workers, and the ever-present din of manufacturing. Nissan plantmen slowly join our walk to the press line. Above us hangs

DIE CHANGE CHALLENGE '88

a blue and white banner: *The Best Die Change Team in America, 1987.*

These men are ready to defend the title they won in last year's competition. But they're not overconfident. In fact, says Tom Posch, department manager of stamping, Nissan held its own qualifying round between the night and day shifts. The day shift won – by :04!

And that team, which we are about to see in action, came in the previous Saturday and practiced for three hours – on company time.

The Nissan team quietly takes their places at the huge tandem line. The change they'll make is from Sentra left-hand front fenders to right-hand front fenders.

Go! Before we know it, the press springs into action. *Chunk. Clang. Whirr. Bang.* There is no cheering, no grunting, just intense concentration from the team. The men at the front of the press are breaking down the line before the first panel is half-way through. No second chances.

By the time the last left-hand panel is out of the press, three of the bolsters are unseated with new dies coming in right behind them.

Chunk. Clang. There are no smiles on Nissan team's faces. The onlookers are equally intense. At :49, every bolster is out and the first new fender is primed to enter the last press.

Chunk. The last press takes the panel into its cavernous jaws. *Clang.* It's stamped. *Whirr.* The press spits the panel out. *Bang.* It's good! 1:20!

The time is announced. You'd expect pandemonium – but Smyrna's QDC team doesn't jump, shout, or slap backs. Instead, they just smile and exchange quick glances. Why no euphoria? "We beat *that* time in practice the other day," says one team member. Onlookers are equally subdued, with one saying, "If anyone beats that, I want to know about it."

Buddy, nobody did.

– Cathy Coffman

Buick City – Flint

This is a welcome change of scenery: on-site stamping. To our way of thinking, when the team gets to see the panels whisked off by conveyor to the body shop, it helps to underscore the importance of QDC.

During our pre-change briefing, we learn that as little as two months ago, the average die change took six hours. One month ago it took two to three hours. Now they've got it whittled down to less than one. If that sounds impressive, chart it. It looks awesome. Another unusual tidbit is that we'll be seeing quarter panels in today's die change. Generally, teams tend to shy away from quarters because they are relatively complex panels.

By the time we actually get out to the line, the team is in place and ready for action. And while there are 18 people involved in this die change, the seven huge presses present themselves to be formidable opponents. The last panel is nearing the lone, hand-fed gap press at the end of the line. Stop watches are up – we're off!

No automatic clamps on these beauties; just raw manpower and King Kong wrenches. Actually, while we're standing here weighing the pros and cons of a bit more automation, it's amazing how quickly these guys manage to get the dies loose. Before we know it, the die carts are in motion. All except one; the problem is quickly diagnosed as a loose connection, and the cart begins to move with only seconds lost.

All is going smoothly but that little glitch did not go unnoticed by the guy with the clipboard who's taking notes. "We check the time it takes to remove and replace the automation, and then any recurring problem we mark on this chart," he says. "And then this gets entered into the computer. Then [pointing] Butch here will make up charts that will show us where the delays are."

At the 10:00 mark, all the new dies are in place and the big wrenches are making the last few turns. All goes well and at 11:00, the first panel goes into the draw die. A quick inspection verifies that the drawn panel is good and it begins its slow journey through the remaining presses. When it arrives at the end of the line, the worker who feeds the gap press gives it the once-over-lightly quality check by hand. The clock stops – 18:16. The panel's good.

Now we get to watch the workers strut, especially the guy who just won the pool for being closest to the actual QDC time. This is also the best clocking yet for this press line. The workers know it, and it is reflected in their words: "Things aren't going so bad here. If some other people out there don't improve, we might just end up taking their jobs."

When you consider what these guys have done with 20+ year old equipment, it wouldn't surprise us a bit.

– Gerry Kobe

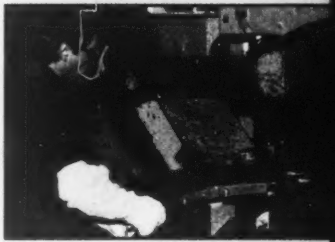
Mazda – Flat Rock

Well, well, well. It comes as something of a surprise, but Mazda's Flat Rock plant has entered the Die Change Challenge – a surprise because the plant is so new that it couldn't have even competed last year if it wanted. From that standpoint the Mazda workers are "green." But as soon as they step into action, it's obvious that they work like seasoned veterans.

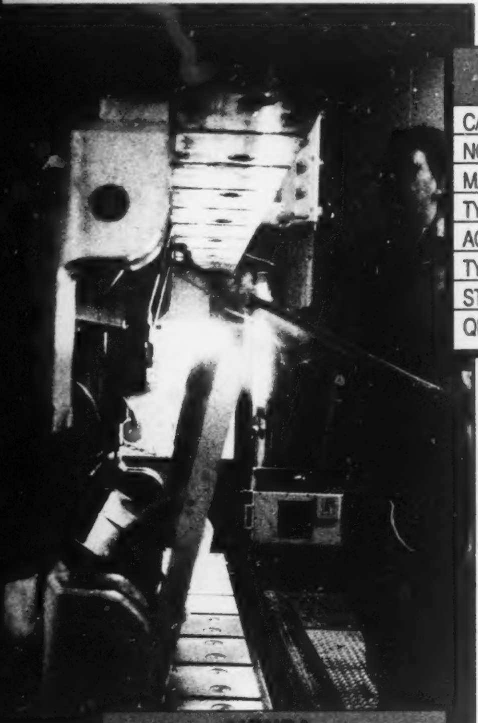
As the last panel comes off the line, we start our stopwatch and the QDC team starts to break down the line. No one is in a rush and the equipment is

CHRYSLER
Warren, MI

CATEGORY: Manual
NO. OF PRESSES: 6
MAKE OF PRESS: USI, Verson, Niagra
TYPE OF PRESS: 250-ton tandem gap
AGE OF PRESS LINE: 30 yrs.
TYPE OF PANEL: Dodge van front fenders
STEEL MAKE: Nippon
QDC TEAM: 26 people
UNION: UAW Local 869



Chrysler Warren: 4:57 on a manual line (above). Magna's Karmax: Canada's super supplier does a 9:39 (right).



KARMAX (MAGNA) Milton, Ontario
CATEGORY: Semi-automated
NO. OF PRESSES: 6
MAKE OF PRESS: Mueller Weingarten
TYPE OF PRESS: Tandems
AGE OF PRESS: 1 yr.
TYPE OF PANELS: Chrys. Premier doors
STEEL MAKE: Nippon
QDC TEAM: 9 people

> *"We developed techniques here that will help all of Chrysler stamping." – Bill Smith, Chrysler Warren.*

HONDA Marysville, OH
CATEGORY: Semi-automated
NO. OF PRESSES: 3
MAKE OF PRESS: Danly
TYPE OF PRESS: tandem
AGE OF PRESS: 6 yrs.
TYPE OF PANELS: Accord floor, Civic hoods
STEEL MAKE: Inland
QDC TEAM: 10 people

under total computer control. The transfer bars disconnect and unclamp. The ram of the press comes down. The die clamps run out. The ram raises. The safety doors go up, and the bolsters slide from one side to the other in unison – they're very close together so as not to waste time.

Then bottom clamps automatically close, the scrap doors rise up and the safety doors come down. Five minutes later the press is ready to run. Forty seconds later the first panel comes off the line. These people are rookies?

Because of their proficiency, Mazda's QDC team makes about three or four die changes per shift, on each press line. Presently, the press shop makes enough panels, about 1800 per run, to keep about 2½ days ahead of the body shop, but the goal is to cut that down to only three shifts. That means QDC has to be a way of life.

"I used to w n a traditional-type stamping plan made up to 20,000 parts per ru had a problem it would be at least three weeks before the fix would come through. That's why we need quick die changes to make small-lot runs," explains Ray Hedding, Flat Rock's manager of stamping. – *John McElroy*

B-O-C Kalamazoo

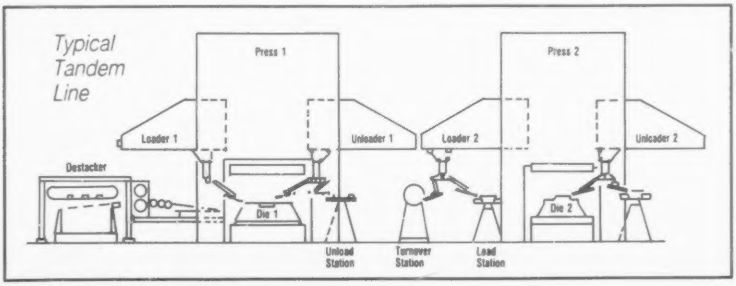
The warm glow of the wood-paneled meeting room creates a perfect backdrop to discuss QDC strategy. Faces of plant manager Steve Pettiford and attending UAW representatives are relaxed, their eyes welcoming. We speak effortlessly as the quiet envelope created by the walls makes even a smile seem audible. But then, something happens: As we enter the plant, lips draw tight with a determined tension, eyes go blank and cold. The silence we had enjoyed only moments earlier fades with each step. By the time we reach the press line, the air has become a torrent of mechanical pounding. The men become machines.

The die change begins. The last panel is still moving down the line and the team is already breaking down the first press. That relaxed look of confidence seen in the meeting room is now worn by every team member.

There are no rolling bolsters, no automatic clamps. We are witnessing a "man's" die change where muscle, sweat and experience move glaciers of steel with uncanny precision.

An overhead crane moves into place. As the operator puts slack in the chains, the crew systematically wraps the links around the die. An almost psychic communication seems to occur as the crane operator "knows" the precise moment to lift. As the crane moves back, the die is dragged out of the press and onto the skids. The crew adjusts the chains for a better lifting position and in seconds, a 50,000 lb die is whisked smoothly away.

By now, the work has followed the first panel to the end of the line and all of the presses are in various stages of changeover. The new die is approaching the first press and the crane opera-


Typical Tandem Line

tor startles us as he uses a swinging motion to set the die further into the opening. With precious few inches to spare, the operator scores a bullseye on every attempt. The crane is then moved to the other side, to drag the die through the press and into position. Methodically, the process is repeated for all four presses.

Smiles begin to appear on the faces of the crew as the final bolts are being tightened on the last press. In the distance, the warning siren of the crane grows less distinct as it carries the dies off to storage. At that moment, the presses come back to life and the first panel begins moving toward a sea of eyes. When the panel drops, a half dozen stopwatches click in unison – 32:00.

The look of calm is back in Pettiford's eyes. "It was all done with ideas that came from the team, not from management telling them from on high down what to do..." His conversation is cut short by his team calling him over for a group photo. That's teamwork! – *Gerry Kobe*

Reatta – Lansing

Want to feel out of place? Walk into the Reatta Craft Centre. It's so different that it makes you feel like you're in one of those "what's wrong with this picture" photos. Much too clean in here to be a "real" stamping facility – no oil to slide around in, no derelict presses sitting around. And why aren't zillions of little bolts and washers embedded in the floor? This ain't right.

Look at that single press line. It looks brand new, and unlike any we've seen.

The only thing "wrong" in this picture is us. To be sure, the cleanliness and organization of this facility are no accident. The workers here are absolutely barrel-chested with pride over this line. Those "new" presses we're looking at are actually the oldest of any we'll see in this year's QDC Challenge. In fact, the presses were salvaged from other GM operations and completely reconditioned for the Craft Centre.

It's showtime! Curiously, the mood is not one of apprehension. Without regard for our cameras, the die change team positions themselves around the presses and watches in perceived indifference as the last panel begins moving through the line.

The change is on, but there is no pseudo-frantic scramble for our benefit. The team of 10 moves purposefully from press to press, working in unison, never at odds. In keeping with the overall "mood" of the die change, the presses are equipped with die carts that move at a steady, deliberate (if not debilitating) pace. Judging from the scuttlebutt, we expect to see next year's carts exhibit a bit more speed.

At 4:00, the die carts are pulling back from the presses and the new dies are being clamped into place. The men work very methodically and smoothly, giving the impression that they can do this day-in, day-out.

Eight minutes have now elapsed and the first blank goes into the presses. Seconds later the metal comes out "ugly" and for a split second twenty eyebrows raise simultaneously. Fortunately, the second blank comes out a "keeper" and makes its way through two more presses, to a 9:33 QDC time.

"With all the parts we've got to run, we have to make at least one die change per shift. We have only one line, and we run all the parts through it," said one team member. We later learned that "all the parts" meant 18 different panels using 73 different dies. All this from one line!

On the way out we made a side trip through the "green room" which plays havoc with your color perception. You might even say that we left Reatta seeing with a "different set of eyes." How appropriate. – *Gerry Kobe*

B-O-C Lansing North

The Quick Die Change at Lansing North has turned into a bit more of a social event than we might have guessed. And while we'll admit that it's interesting, it does seem that as we make our way to the plant's meeting room, there is an inordinate number of non-die change types lurking about.

"I think they're from the magazine," confides one woman to another. "Tourists," is the reply. Oh-oh, sounds hostile. We quicken our pace.

Once in the meeting room we settle in for a thumbnail sketch from plant manager Mike Camp. Because this plant is a return QDC competitor, Camp's outline of the plant's progress is of particular interest to *AI*. "True jointness is increasing," he says. "We're finding that we can tackle even tougher problems now." As our discussion continues, we learn that one year ago, uptime in the plant was 58%. Today, uptime is around 68% and the improvements in die changes are getting the credit.

B-O-C (GM)
Buick City, Flint, MI

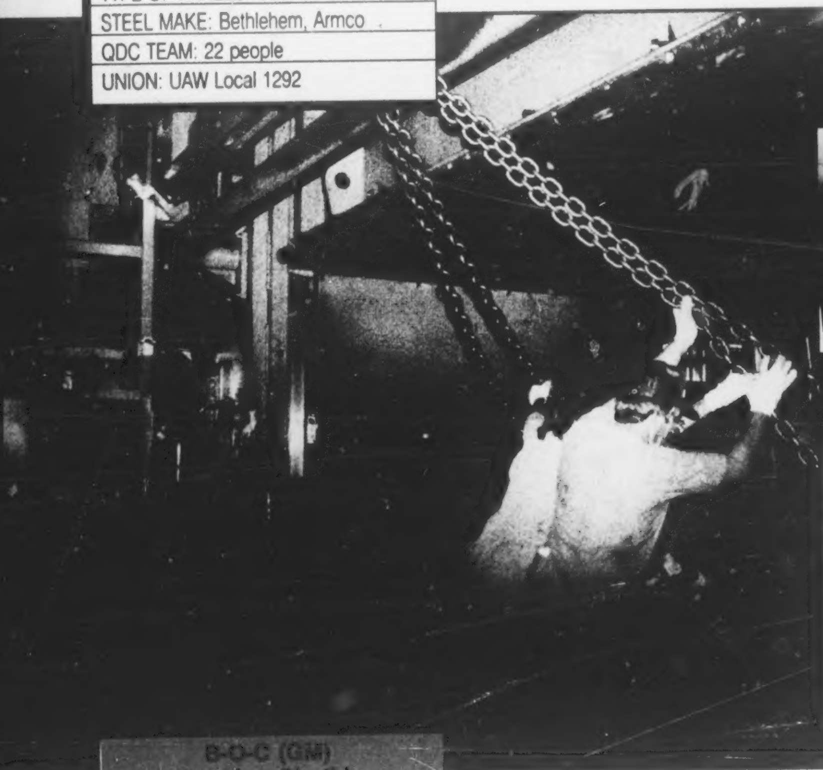
CATEGORY: Semi-automated
NO. OF PRESSES: 7
MAKE OF PRESS: Danly
TYPE OF PRESS: Tandem
AGE OF PRESS: 22 yrs.
TYPE OF PANELS: Buick LeSabre ¼ panels
STEEL MAKE: LTV
QDC TEAM: 18 people
UNION: UAW Local 599

> *"It was all done with ideas from the team, not from management." – Steve Pettiford, B-O-C Kalamazoo.*

Camp suggests we go to the press line because the die change is ready to begin. As the team goes to work, their method causes us to draw an interesting comparison to racing. You've probably heard it said that the guy who is going the fastest on the track generally doesn't *look* like he's fast. That's because he's so smooth that he makes it look easy. Well, guess what? These guys are getting into the presses and automation faster than last year, but they make it look easy.

The pick-and-place hardware has been color-coded and equipped with quick-disconnect clamps to streamline the operation. In less than 4:00, all the

B-O-C (GM)
Grand Blanc, MI
CATEGORY: Manual
NO. OF PRESSES: 5
MAKE OF PRESS: Danly
TYPE OF PRESS: Tandem
AGE OF PRESS: 31 yrs.
TYPE OF PANELS: Cadillac DeVille doors
STEEL MAKE: Bethlehem, Armco
QDC TEAM: 22 people
UNION: UAW Local 1292



B-O-C Kalamazoo: Ballet-like precision on a manual line. 32:00

REATTA CRAFT CENTRE (GM)
Lansing, MI
CATEGORY: Semi-automated
NO. OF PRESSES: 3
MAKE OF PRESS: Danly
TYPE OF PRESS: Tandem
AGE OF PRESS: 35 yrs
TYPE OF PANELS: Buick Reatta doors
STEEL MAKE: Armco
QDC TEAM: 10 people
UNION: UAW Local 1618

B-O-C (GM)
Lansing (North)
CATEGORY: Fully-automated
NO. OF PRESSES: 7
MAKE OF PRESS: Danly
TYPE OF PRESS: Tandem
AGE OF PRESS: 20 yrs.
TYPE OF PANELS: Pontiac Grand Am fenders
STEEL MAKE: Inland
QDC TEAM: 20 people
UNION: UAW Local 652

bolsters have stopped moving and the first panel is on its way. The team has performed brilliantly, but by nature the line works against their efforts. This is a seven-press line with two stations between the presses. Even when it's up and running it takes about 3:00 for the panel to run the gauntlet.

At 8:00 the panel is entering the last press and the sizable crowd begins polite applause. The volume of their approval slowly grows until, at 8:34, the first panel stops the clocks. The dark aisles are momentarily alive with voiced approval, but quickly return to a mix of handshakes and congratulatory chatter. The team has proved their point. Their time is over 1:00 faster than last year.

—Doug Willams

Honda—Marysville

As our "Die Change Tour '88" caravan rolls into Honda's Marysville, OH complex before dawn, caffeine and pre-QDC adrenaline have us anxious. But so does just being here. Each time we visit Marysville, we're hit with the feeling that in this plant, yesterday's best work is not good enough for today.

Marysville has four stamping lines. The semi-automated tandem press team won our inaugural QDC Challenge in 1986, with the fast time of 5:14. Last year, they dropped that to 4:38, again the top semi-auto squad.

For the second year in a row, Honda will be showing us die changes on two press lines—the B-line of three tandem presses (Honda II in the charts) and the fully-automatic transfer press on D-line (Honda I). The latter is a 4700-ton colossus, one of the three largest stamping presses in the world. The big press has been running 12 strokes a minute, and we're amazed that the people at the end of the line can keep up. But they hold a plant record for production—4731 parts per eight-hour shift.

After a pre-QDC pep talk in the stamping shop, the D-line QDC team

DIE CHANGE CHALLENGE '88

of three gets ready. Only two people regularly run this die set, but I've been given the honorary nod to start the automation. As the Hitachi monster pounds out its last left-side Civic door panel, there's a brief countdown, then "*Hit it!*" I punch a large red button; the die change begins.

For the next 6:03, there's not much to do but behold the computer mastering the beast. Within the Hitachi's steel belly, transfer mechanisms are cleared away. Safety gates on the opposite side of the press rise and the left-side dies roll out on adjacent bolsters, while the right-side door panel dies roll in on our side. This all happens three times a shift here.

When it's over and the first new panel is deemed 'good', this QDC has taken :22 longer than last year's. No one seems concerned.

A few minutes later we're over on B-line. Last year the QDC team on this three-press line swapped dies in a blazing 4:38. This year's team of 10 once did five die sets in a day, and they casually claim that sub-5:00 changes are now the norm. We'll see.

Go! The safety gates are barely up as the team assaults the trio of presses, swarming into them as the Accord floorpan dies exit one side. The semiautomatic presses require some manual attention inside—jigs and handling arms are set up, the tops of the dies have to be banged down and everything is adjusted. Before we know it, the gates are going down and a steel blank is heading for the Civic hood dies now in place. *Bang!*

The fresh hood panel is OK'd. Our stopwatches click at the 3:57 mark, a B-line record. Everybody's happy, but they soon go back to business. That's the way it is at Marysville, where this year's quickest die change becomes next year's routine.—*Lindsay Brooke*

Cadillac—Grand Blanc

Grand Blanc (pronounced Grand Blank)~~—is~~ the last stop on our QDC tour. As we enter the plant, we notice some photos of Sherman tanks that serve as clues to the age of this facility. Sherman tanks? Indeed. This plant built Shermans during WW II and Patton tanks for the Korean War.

But between the photos and the aging wooden floors, we begin to get the idea that as far as the QDC Challenge is concerned, the plant may have bitten off more than it can chew.

We walk past the silent ruins of presses that retired long ago and wonder what lies ahead. Do these guys know what they're up against? Do they know how good the competition really is? When we reach the meeting room, we're stunned to learn that the plans to participate in our Challenge are only two months old. As details unfold, they tell of the battle to reduce die change times from 12 hours in early 1986 to 8.5 hours a year later.

"Two weeks ago," we're told, "we were down to four hours."

We try to get a feel for what to expect by asking for predictions on today's die change.

"No predictions," comes the cool reply. "Let's just go out and give it our best effort."

It's a spunky answer but considering that we're dealing with wrenches and die trucks, it's going to have to be a hell of a best effort.

We approach a line of ancient-looking presses, but are thrown off-guard by what we see. Gathered around the press line, there is a pumped-up, fire-breathing crew of wildmen, all wearing bright mustard-colored T-shirts with the Cadillac emblem and "Grand Blanc" on the front. They're already slapping each other on the back as the last panel comes down the line, but their eyes stay riveted to the presses.

The panel drops. A whistle blows. The aisles erupt in a wash of action. We've been duped! Not only is this team fast, they also have better choreography than the June Taylor Dancers. As yellow shirts dart in and out of the presses, the whistle continues to blow signaling the team to break down the next press. They are literally going too fast to photograph.

The concentration involved in this die change is unreal. Everywhere you look you see people scrambling to help one another and keep the change safe. As the die trucks pull back, there is a "Red Sea" effect among the workers that insures a clear path. Inside the presses, we see workers doing two jobs at once—one hand tightens the die, the other hand clears a chain—unreal!

So much has happened so fast, that it's hard to believe that after only 2:32 the first panel is starting down the line. A man with a bull horn is starting to count down the seconds as the panel approaches the last press. As we move down the line alongside the panel, we realize that we are walking toward an enormous crowd that has picked up the countdown from the bullhorn.

[illegible]
CATEGORY: Manual
NO. OF PRESSES: 4
MAKE OF PRESS: Danly
TYPE OF PRESSES: Tandem
AGE OF PRESSES: 20 yrs.
TYPE OF PANEL: Olds/Buick doors
STEEL MAKE: Bethlehem
QDC TEAM: 22 people
UNION: UAW Local 488

"Go, go, *go*"—4:50, 4:51, 4:52—"Come on!"—4:55—"We're gonna do it"—4:58...PANDEMONIUM.

The stopwatches stop at 4:59 and the crowd is absolutely alive with energy. This old plant is in its glory.

We work our way back to the meeting room with the die change team in tow. Behind us the crowd is burned by the heat of the moment and continues to celebrate. When we get to the room we are presented with "Grand Blanc" T-shirts which somehow seem to be the appropriate dress. Once in uniform, we wade through the crowd in time to hear some great commentary: "Jerry," says one of the workers to the plant manager, "if you want us to do it in under 3:00, you've got to give us more than one week to practice!"

NISSAN
Smyrna, TN

CATEGORY: Fully-automated
NO. OF PRESSES: 5
MAKE OF PRESS: Hitachi-Zosen
TYPE OF PRESSES: Tandem line
AGE OF PRESS LINE: 5 yrs.
TYPE OF PANELS: Sentra fenders
STEEL MAKE: Mitsui
QDC TEAM: 9 people

Similar sentiments are expressed by several team members. "Nothing's impossible," boasts a voice. The mood is definitely up; QDC has worked its magic. – *Gerry Kobe*

The Envelope Please

It's time to for the results – as if you hadn't already peeked at the charts! But the raw numbers don't tell the whole story, because they can't capture the emotion of the event.

If we had to pick the most exciting die change team in action, we'd have to call it a tie between Chrysler's Warren Stamping plant and GM's Grand Blanc operations. Their elation was contagious.

If there was an award for the most dramatic team in action, then the men at GM's Kalamazoo plant get the gold for their awesome performance.

For consistency and constant improvement, the people at GM's Lansing operations have shown that as long as *AI* wants to keep coming back, they'll keep getting better.

And the QDC teams at Honda have shown that they are – hands down – the most professional in the business.

In the final analysis, there are fond memories and excitement that we're going to keep from every plant we visited.

But the best of the bunch, for the second year in a row, is the QDC team from Nissan. They are simply so quick, you have to wonder how they can improve their time next year.

Next year! Suddenly our thoughts turn to how we're going to handle Die Change Challenge '89. What if more plants want to compete? Do we have the budget and time to cover it? After all, just trying to cover the teams that entered this year tied up the *AI* staff for weeks. We bounce ideas around...maybe we should have an entry fee, or maybe we should have a qualifying time...

We've come to the conclusion that if so many QDC teams can figure out how to organize themselves into world-class competitors, then you can be sure that *Automotive Industries* will be there to tell the story. AI

"Nothing's impossible." – Cadillac Grand Blanc worker.

AND THE OVERALL WINNER IS...

The winner of each category was awarded 12 points, the second place finisher 11, etc. By adding up the points in each category, we were able to determine the overall placing of each plant.

1. NISSAN
2. HONDA I.
3. HONDA II.
4. MAZDA
5. KARMAX (MAGNA)
6. REATTA CRAFT CENTRE
7. B-O-C GRAND BLANC
8. CHRYSLER WARREN
9. B-O-C LANSING (North)
10. B-O-C BUICK CITY
11. GM TRUCK & BUS
12. B-O-C KALAMAZOO

AUTOMAKER QUARTERLY REPORT

Transplants battle domestics for the third quarter market.

by DR. THOMAS O'GRADY

We hear much discussion about the domestics being strong this year, but we also see foreign cars moving higher on the top 10 list. Third quarter transplant sales accounted for 9.1% of total car sales.

Through new products and improvements in quality, Ford and Chrysler gained market share during the third quarter. GM still suffers from a poorer image and slow product development, losing 1.1 percentage points of industry share during the quarter. GM needs to improve its selling rate during the fourth quarter to avoid further losses in share.

There are major shifts in market share by geographic base so far this year. Japanese share for the quarter fell from 21.4% to 20.9% and the Europeans suffered an even bigger loss. Meanwhile, share of the industry's "other imports" (which should add cars from Taiwan and Malaysia during '89) grew to 4.9%.

Dr. Thomas O'Grady heads Integrated Automotive Resources, Inc. in Wayne, PA.

Most foreign manufacturers lost share in the third quarter. Toyota and Honda are still doing very well, but Nissan's weak product line resulted in a third choice position. Isuzu and several of the European companies (notably Volvo, Porsche, and Yugo) still show severe signs of weakness.

The Ford Escort, responding to heavy incentives, returned to the top spot for the quarter, while Honda's Ohio-built Accord moved ahead of Corsica/Beretta to become the first foreign nameplate in the No. 2 position.

Each of the Big Three increased their its third quarter light truck shares. Greater acceptance of the Chevrolet pickups—which outsold Ford's full-size pickups during August—was partially responsible for raising GM's share from 32.6% to 35.0% this quarter. Meanwhile, most imported pickups continue to suffer from higher prices and image problems.

WHAT'S HOT! US Auto Sales (3rd Quarter Results)

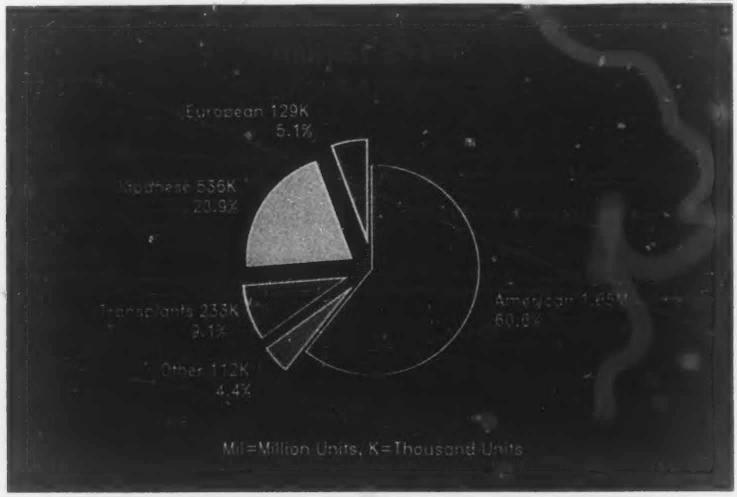
Carline	'88	'87	% Change
Escort	102,539	114,048	(10.09%)
Accord*	90,849	87,084	4.32%
Corsica/ Beretta	84,913	89,272	(4.88%)
Sentra	77,764	61,014	27.45%
Taurus	75,944	99,581	(23.74%)
Cavalier	73,560	68,769	6.97%
Tempo	69,608	45,339	53.53%
Ciera	67,742	70,049	(3.29%)
Excel	60,473	78,421	(22.89%)
Camry	59,906	53,252	12.50%

* – Includes imports
( ) – Negative value

US Passenger Car Market Shares 3rd Qtr '88

Manufacturer	Sales	% Total
General Motors	2,941,295	36.38%
Ford	1,751,138	21.66%
Chrysler	919,124	11.37%
Honda/Acura	564,036	6.96%
Toyota	493,078	6.88%
Nissan	367,099	4.53%
Hyundai	208,966	2.58%
Mazda	197,449	2.43%
VW/Audi	152,869	1.87%
Subaru	116,429	1.44%
TOTAL	7,711,483	

(Continued p.84)



Passenger Car Market Share By Geographic Base

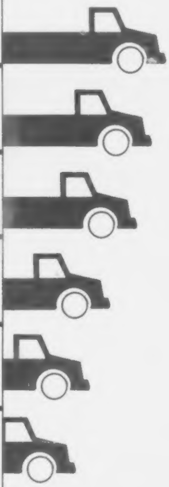
Third Quarter 1988

Manufacturers	**Total Sales**	**Total Market Share**
American	1,555,894	60.64%
Japanese	536,182	20.90%
European	129,507	5.05%
Transplants (VW, Honda, NUMMI, Nissan, Mazda/Ford)	232,623	9.07%
Other Imports (Excel, Festiva, Fox, LeMans, Precis)	111,644	4.35%
Total	**2,565,850**	**100.00%**

THIRD QUARTER DOMESTIC LIGHT TRUCK PRODUCTION

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 1988	TOTAL 1987
FORD	133,572	67,983	50,052	46,029	9048	25,370	332,054	309,319
CHEVROLET	128,531	80,303	37,127	43,954	29,497*	31,870	351,282	309,983
GMC	44,393	16,528	12,168	11,142	8498	13,421	106,150	96,434
CHRYSLER	20,781	20,849	24,195	100,846	5115	—	171,786	149,646
JEEP	—	9683	—	—	2313	55,429	67,425	60,604
NISSAN	—	14,969	—	—	—	—	14,969	23,975

*Includes Suburban and P-model



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DECEMBER 1988

AUTOMOTIVE INDUSTRIES

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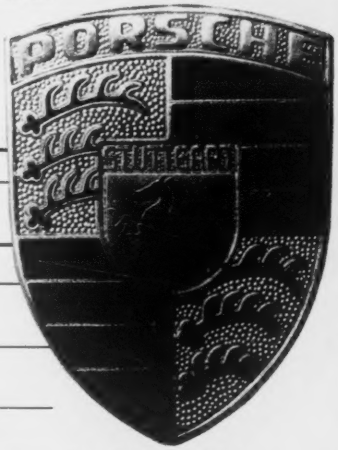
SINCE 1895



Cover: Porsche's R&D Center at Weissach, W. Germany is one of the industry's finest. On page 42, we take you inside for a tour and an assessment of Weissach's capabilities.

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It's A Start

American cars have never represented big numbers in Japan, but it looks like the Accord Coupe could help to change all that. The car was an instant success when introduced in Japan and is the primary reason for the dramatic changes in **US-built car registrations**. Has Honda broken the ice?

NEW REGISTRATIONS OF IMPORTED CARS TO JAPAN

	Aug. '88	Aug. '87	% Increase
USA	981	283	246.6
UK	738	538	37.2
W. Germany	6784	5608	21.0
France	529	401	31.9
Italy	371	322	15.2
Sweden	533	367	45.2
Others	23	13	76.9
TOTAL	9959	7532	32.2

Subaru's News

Used to be that when you bought a Subaru, you only had to say: wagon, sedan or coupe. But now, in addition to the XT and Justy, Subaru is bringing out a **new line of Accord/Camry fighters** (April '89) and a new name to go with them. The line will be called "Legacy" and it will be available in upscale four-door sedans and station wagons. These cars will be offered in addition to the current line of sedans, wagons and coupes, but just so that there is no confusion, Subaru has decided to give its bread-and-butter line a name too. These cars will be named "Loyale," which, according to marketing VP David L. Sippel, "...not only reflects the way Subaru owners feel about their cars, but it also signals a renewed marketing effort for our highest-volume, high-value models."

Sittin' Pretty

Lear Siegler Seating Corp. currently enjoys a 38% share of the domestic seating market. And they intend to keep it. LSSC is working on projects that will advance the current state-of-the-seating-art to include: **active seats** – which will adjust bolsters as you drive; **reversible seat** cushions – much like you have on your sofa – for added wear, **conformable seats** – that make all adjustments automatically and even **voice-activated seats** – for the man who has everything.

A little further down the road, we may see temperature-controlled, **gel-filled seats**. This concept would use a shock-absorbing gel – similar to that used in some athletic applications – in place of the seat suspension. Another definite maybe is a one-piece, **plastic seat** frame, that would create a built-in suspension, by cutting cantilever slots in the cushion area. Early tests show that this seat is feasible and would save both weight and cost.

Transplant Suppliers Disappointed

Of the Japanese OEM component suppliers which have set up shop in the US, 40% are disappointed with the American market. According to a recent study by management consultants A.T. Kearney, the transplant suppliers realize that business with only the Japanese automakers now operating in the US is not enough to support their capital investments. To these companies, Kearney recommends strategies such as **cracking the Detroit market** *via* joint-ventures with US suppliers, exporting US-made components back to Japan or to Europe and becoming a source for technology and products unavailable from the Big Three. Of the joint-venture strategy, Kearney suggests the Japanese pick their partners very carefully, to find the best ones for mutual market potential.

Say Watt?

The marriage of Delco/Bose has provided sweet sounds in many of GM's higher content models, but Cadillac felt that exclusive cars deserved exclusive sound systems. Delco Electronics was happy to oblige and has just introduced the **Delco/Bose Gold music system**. The "gold" option puts 200 watts of power into the De Ville and Fleetwood models and a full 170 watts into Seville and Eldorado. Controlling all this power are standard auto-reverse cassette with Dolby; optional CD player or a Digital Audio Tape (DAT) player.

TOP SUPPLIERS 1988

Automotive Industries' exclusive alphabetical listing of the industry's top OEMs.

COMPANY	1985 SALES*/PROFIT	1986 SALES*/PROFIT	1987 SALES*/PROFIT
AC Spark Plug (GM)	NA	NA	NA
Accustar (Chrysler)	NA	NA	NA
Acme-Cleveland	213/4.6	186/(1.8)	176/11.3
Airpax Corp.	NA	NA	NA
Akzo	NA	NA	NA
Alcoa	6,684/(16.6)	6,505/254	7,838/200
Allied Corp.	8,183/(279)	9,888/605	11,116/656
AMP	1,636/108	1,933/164	2,317/250
A.O. Smith	897/27.8	911/26	970/15.4
Armco	2,936/45	2,640/(362)	2,927/118
Armstrong Rubber	NA	866/(37.6)	NA
Arvin Industries	821/35.9	995/41.2	1,373/47.6
Ashland Oil	7,891/147	6,991/208.6	6,993/161
Atlantic-Richfield	23,100/(202)	15,800/615	17,600/1,224
Armco	NA	NA	NA
Armstrong Rubber	NA	NA	NA
Ball Corp.	1,106/51.2	1,070/58.9	1,054/66
BASF/Inmont	2,568/38.9	3,645/104.6	NA
Bethlehem Steel	5,117/(196)	4,333/(152.7)	4,620/174
Borg-Warner	3,963/178	3,623/206.3	3,500/NA
Briggs & Stratton	717/33.5	745/34.1	785/26.6
Brown & Sharpe	120/6.3	137/(1.2)	152/(1.1)
Budd Co.	NA	NA	NA
Carpenter Technology	556/24.5	517/7.7	480/4.5
Caterpillar	6,769/198	7,321/76	8,180/350
Celanese	3,046/178	2,891/213	4,596/169
Central Foundry (GM)	NA	NA	NA
Champion Spark Plug	829/15.2	883.8/1.0	720/24.4
Cherry Automotive	26.9/(2.3)	22.7/2.7	14.6/7.4
Cincinnati Milacron	732/(44.7)	849/23.3	827/(79.9)
Clark Equipment	964/(85.4)	954/(60.6)	1,048/(16.6)
Colt Industries	1,579/138	1,616/89.3	1,642/75.0
Computervision	441(80.7)	495/(5.8)	564/19
Cross & Trecker	402/11.7	399/.189	422/(24.4)
Cummins Engine	2,146/50.3	2,303/(107)	2,767/13.8
Cyclops Corp.	1,385/26.2	NA	NA
Dana Corp.	3,754/165	3,695/117	4,142/132.9
Deere & Co.	3,163/31	3,516/(229.3)	4,134/(99.0)
Delco Electronics (GM)	NA	NA	NA
Delco Morraine (GM)	NA	NA	NA
Delco Products (GM)	NA	NA	NA
Delco Remy (GM)	NA	NA	NA
Diver. Prod. Oper.(Ford)	NA	NA	NA
Dow Chemical	11,537/58	11,113/732	13,377/1,240
Dow Corning	901/95.2	1,085/110.6	1,303/135
Dresser Industries	4,111/(196)	3,661/9.6	3,120/49
Dupont	29,483/1,118	27,148/1,538	30,468/1,786
Eagle Picher	641/(119.8)	648/38.8	677/39.9
Eaton	3,674/231	2,760/138	3,138/201
EDS	3,444/190	NA	NA
Emhart	1,775/80.5	2,094/(10.2)	2,454/106
Englehard	2,263/42.6	2,289/53.3	NA
Essex Chemical	190/8.5	205/8.8	NA
Ex-Cell-O	NA	NA	NA
Federal Mogul	895/44.7	941/29.1	1,075/36.5
Firestone	3,836/3.0	3,712/85	3,867/145
Fisher-Guide (GM)	NA	NA	NA
FMC Corp.	3,260/196.5	3,003/152.5	3,139/191
GenCorp.	1,457/75	1,537/130	1,619/475
General Electric	28,285/2,336	35,211/2,492	40,515/2,915
General Instrument	993/(9.6)	794/(46.8)	788/(80.3)
Gleason Corp.	228/.78	252/1.6	229/(1.3)
Goodyear	9,896/412	10,328/124	9,905/771
Gould	1,520/(175)	1,437/(101)	933/(95.6)

(Continued)

**–In millions of dollars. Figures taken from Fortune 500 and company reports.*
NA–No public listing or not available.

TOP SUPPLIERS 1988

COMPANY	1985 SALES*/PROFIT	1986 SALES*/PROFIT	1987 SALES*/PROFIT
Harvard Industries	205/8.6	314/12	559/17
Hercules	2,587/133	2,615/227	2,693/821
Inland	3,186/(178)	3,173/19.3	3,453/145
IPC	116/NA	120/NA	123/NA
Intermet	265/13	295/19	317/21.4
ITT	14,663/294	17,437/494	19,525/1,018
J.P. Industries	133/6.4	234/10.8	386/14.8
Kaiser Aluminum	1,774/(190)	1,967/(39.8)	1,987/(362)
Lear-Siegler	2,370/101	2,464/55	NA
Litton	4,590/299	4,521/71	4,419/138
Loctite	240/19	266.8/23.2	337.8/30.7
LTV	8,198/(724)	7,271/(3,251)	NA
Lubrizol	903/60.2	985.2/78.2	1,022/81.3
Magna International	690/38	1,027/47	1,152/40
Mahle	NA	NA	NA
Masco	599.1/2.90	712/9.4	2,233/218
Maremont	NA	NA	NA
Midland-Ross	763/19.4	NA	NA
Mobay	1,599/77	NA	NA
Modine	312/20	349/19.7	395/25
Molex	253/31	292/32	387/43
Monsanto	6,747/(98)	6,879/433	7,639/436
Morton Thiokol	1,832/195	1,950/133	1,987/138
National Steel	2,082/(88.4)	2,128/(59.8)	2,416/47.8
Navistar	3,508/(364)	3,357/2	3,530/33
New Departure/Hyatt (GM)	NA	NA	NA
Norton	1,193/(130)	1,107/(33)	1,260/66.5
Owens-Corning	3,305/131	3,644/15.6	2,891/200
Phillips Pet.	15,676/418	9,770/228	10,721/35
PPG	4,345/303	4,687/316	5,183/377
Prab	19,374/(.843)	22,003/(.784)	19,591/(1.1)
Quaker State	974/46	899/50	NA
Quanex	297/10.1	325/(19.9)	345/5.2
Raychem	679/28	797.6/48.8	944.4/73.6
Rexnord	1,103/36	1,093/(104)	NA
Reynolds Metals	3,500/(292)	3,753/192	4,284/219.5
Rockwell	11,338/595	12,296/611	12,123/635
Sheller Globe	918/364	863/12.8	774/92
Sherwin-Williams	1,522/1.6	1,553/1.9	1,793/2.1
Simpson	139/7.4	171/9.9	147/5.3
Snap-On Tools	591/298	670/331	754/377
SPX (Sealed Power)	624/30	665/28.5	774/26
Stanadyne	484/30	493/21	NA
Standard Products	377/21.5	433/27.2	465/31.5
Stanley Works	1,006/78	1,371/78.7	1,763/86.6
Starrett	NA	123/12.7	169/15.8
Superior Industries	130/7.3	148/8.5	169/9.5
Tecumseh Products	829/60	821.1/50.2	951/71.6
Tektronix	1,438/90	1,352/39.3	1,396/51.2
Teledyne	3,256/546	3,241/238.3	3,217/377
Textron	4,990/.252	5,023/244	7,200/256
3M	7,846/664	8,602/779	9,429/918
Timken	1,090/(4)	1,058/2.7	1,230/10.3
Trinova	1,233/74.6	1,447/122	1,681/75
TRW	5,917/(7)	6,036/218	6,821/243
USX	20,779/598	14,938/1,833	14,836/219
Union Carbide	6,390/(581)	7,828/496	6,914/232
Uniroyal-Goodrich	NA	NA	NA
United Technologies	14,991/313	15,670/73	17,170/592
Walbro	67/5	98/6.6	110/7
Weirton Steel	1,156/40	1,173/30	1,329/80
Wickes	2,806/28	477/84	2,148/83.7

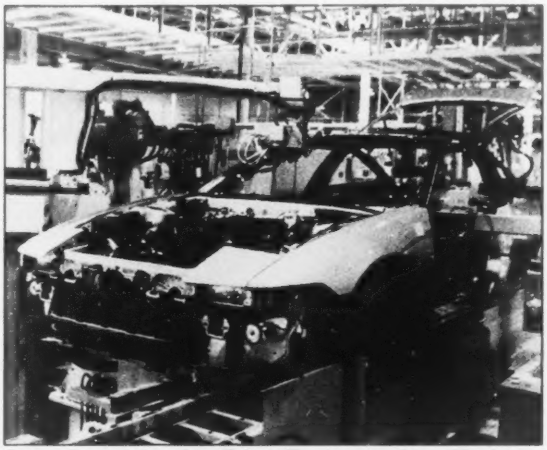
** – In millions of dollars. Figures taken from Fortune 500 and company reports.*
NA – No public listing or not available.

AI PLANT TOUR

LITTLE BIG PLANT

The new Mitsubishi-Chrysler plant re-writes the book on space efficiency.

By JOHN MCELROY



Doors-off installation of the Eclipse IP using one of the 470 robots.

DIAMOND-STAR vs. FLAT ROCK PLANT COMPARISON

LOCATION:	Bloomington-Normal, IL	Flat Rock, MI
PRODUCTS:	Chrysler Laser/ Mitsubishi Eclipse	Ford Probe/ Mazda MX-6
INVESTMENT:	\$650 million	\$550 million
PLANT SIZE:	2.0 million ft^2	2.7 million ft^2
LINE SPEED:	62 cars/hour	68 cars/hour
CAPACITY:	238,000 cars/yr	261,000 cars/yr
ROBOTS:	470	350
EMPLOYMENT:	2900	3100
MAN HOURS PER CAR:	23.3	22.7

Like the other Japanese transplants, Diamond-Star is smaller, more efficient and cost less to build than any American assembly plant. In fact, considering how many cars it builds, it may be world's most space-efficient plant.

Total area under roof is 2.0 million ft^2. But if office and storage space is excluded, the actual production area is only 1.4 million ft^2! And this facility can build nearly 240,000 cars a year, including major stampings and plastic moldings.

The long, narrow layout of the plant has a lot to do with its small size. Mitsubishi believes that one long assembly line is the best because every U-turn in a line creates dead space that can't be used efficiently.

According to Yoichi Nakane, president of Diamond-Star (D-S), the plant represents a \$650 million investment. A new American plant typically costs over \$1 billion. And it's not as if D-S tried to scrimp and save to keep the price down. There are over 470 robots used in the plant, which is twice as many robots as you're likely to find anywhere else. All the robots are made by Mitsubishi Motors and Mitsubishi Electric.

"My financial people didn't have the same pressures that the financial people at some other companies have. They didn't cost-justify all 470 robots just on price—they justified them on quality," says Glen Gardner, chairman of D-S.

Diamond-Star's highly automated press shop uses more press lines than do its transplant competitors. There are two blanking presses and five Komatsu transfer presses to make 72 body panels which are two-side galvanized. This extra press line capacity will be used to make only two days' worth of parts, about one half the lot size typically used elsewhere.

As the blanks come off the blanking line, they are brought by AGVs to the press line. As the panels come off the line they are automatically stacked into pallets. The pallets are automatically stacked in a hi-bay storage area, then retrieved by AGVs to be whisked to the body shop. Except for a quick inspection at the end of the press line, the Nippon steel is untouched by human hands.

Next to the press shop is a plastics shop that makes six different types of bumper fascias on nine RIM machines.

About 90% of the welding at Diamond-Star is done by robot. There are 72 robots used for sealing alone. All locater pads on the welding equipment is hand-ground to spec. No shims are used. Either the body is welded to spec, or it doesn't go together at all.

Each body goes through a three-coat paint process, with the first coat of primer being dipped on, not sprayed. Every car is clear-coated, too. Unlike any other assembly plant *AI* has visited, there are no accumulator banks before or after the paint shop.

After leaving the paint shop, the doors, hood and liftgate are automatically removed. And this is where the robots are really put to work. They install the tires, seats, powertrain cradle, rear suspension, gas tank, battery, glass, IP, bumpers, doors, hood and liftgate. With so many robots being used, D-S is proceeding very carefully.

"If I tried to launch a plant with over 400 robots like Dick Dauch launches a plant with a launch curve like this," says Glen Gardner, moving his hand as if it were a Saturn V rocket blasting off, "I'd be in trouble."

CHILTON'S
TRUCK &
OFF-HIGHWAY
INDUSTRIES

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The big truck honeymoon is over, says John Stark

FEATURES

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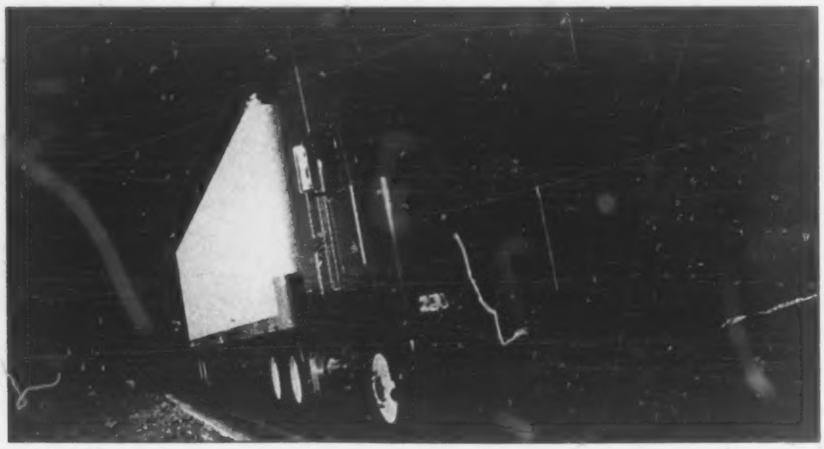

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NEXT ISSUE

In January, T&OHI features the latest on heavy truck design.

For Trucks, The Party's Over

by John Stark

The party is nearly over...for manufacturers and suppliers in the commercial truckmaking business.

Soaring US demand for medium and heavy-duty trucks will soon run out of steam.

Officials believe retail sales of Classes 3-8 trucks will peak by 1988 yearend at about 345,200 units, and decline thereafter during the next three to five years.

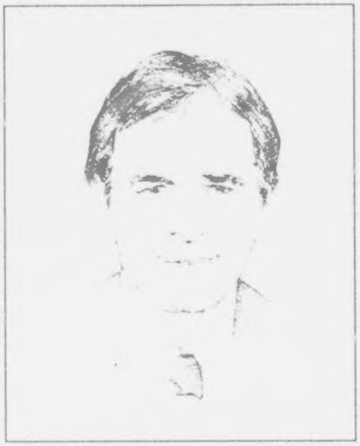
Mack, Freightliner and others see 1989 demand for Class 8 trucks falling anywhere from 5½% to 13%. Class 3-7 truck sales will likely drop by 4½%. Blame for overall truck sales slowdown is linked to outlooks of slowdown in growth of the US GNP.

Hence, truck industry upturn in the post-1980 deregulation period is seen coming to an end next year after peaking this year at the highest level since 1979 when 390,189 trucks were sold.

However, trucking deregulation dramatically shook up industrywide buying patterns during this period of economic growth. Coast-to-coast trucking fleets turned to the use of regional hubs to serve their business accounts, under trucking deregulation.

Big trucking fleets subsequently no longer needed high COE Class 8-type trucks with 400 horsepower or more. Reduced travel distance, laws permitting the use of wider and longer truck-trailer combinations, and 55 mph speed limits altered market buying.

High COE, 400 hp trucks quickly fell from grace in the marketplace. Demand shifted to medium- and long-nosed, 250 hp Class 7-8 conventionals.



John Stark is editor and publisher of Stark's Off-Highway Ledger.

Kenworth is generally regarded as the first truckmaker to identify the changing trucking needs with the late 1985 launch of a new line of conventional trucks – Baby 8s. Its T600A model long-nose set the standard for others that followed a year later.

Not only did nationwide trucking deregulation swiftly change the course of business events for Class 8 commercial vehicle makers, it also sent component suppliers back to the drawing board for new families of parts.

Cummins, for example, came to the market with a new family of 10-L diesel engines that quickly became popular specification items. Caterpillar and others followed suit, prompting similar changes in drivetrain design.

Suppliers of cabs and various cab parts were especially affected by the shift to conventional from COE-type trucks. However, the three-year gain in conventional truck demand may have already run out of steam. Through 1988, US market penetration of COE-type vehicles has rebounded to nearly 27% of overall retail sales, the highest level since 1985.

Some truck industry insiders see resurrecting demand of COE-type vehicles, as well as alternating rise and fall in net incoming orders for heavy trucks since March 1988, as signs that Baby 8 truck business will surely wane next year by as much as 9½%.

The $64,000 question for commercial truckmakers is not whether a downturn looms but rather, what will be the *extent* of downside in the business cycle. Will US truck sales decline during the next two to three years and rebound afterwards? Or will the drop be marginal in nature and remain relatively flat through the next five years?

"To tell you the truth, opinions within Freightliner are divided in that regard," says Ernst Stoeckl, Freightliner president and CEO. "We believe that during the next five years, we'll see a decline (in industrywide truck sales), followed by a recovery, but not to the 144,000 unit level of 1988. We foresee the market fluctuating within a narrow band, to a minimum of 105,000 and a maximum of 130,000 units beyond 1989." ■

U.S. MEDIUM & HEAVY-DUTY TRUCK SALES OUTLOOK

	1989	*1988*	*1987*	*1986*	*1985*	*1984*	*1983*	*1982*	*1981*	*1980*
Class 3	13,500	13,900	14,009	12,758	10,854	6,019	145	1,062	748	3,510
Class 4	26,000	22,300	2,129	768	--	4	2	9	12	195
Class 5	8,000	8,000	8,185	6,505	5,081	5,417	1,159	1,434	1,916	2,309
Class 6	51,000	55,000	44,282	45,046	48,358	55,482	46,532	44,214	71,993	89,764
Class 7	94,000	102,000	102,583	100,713	96,973	78,479	59,383	62,488	51,402	58,436
Class 8	130,000	144,000	131,156	112,871	133,581	137,693	81,647	75,777	100,334	117,270
TOTAL	322,500	345,200	302,344	278,661	294,847	283,094	188,868	184,984	226,405	271,484

Source: U.S. Motor Vehicle Manufacturers' Association.
Note: 1989 and 1988 data represent forecasts, subject to revision.

NO BLITZKREIG

Medium import trucks have gained a growing beachhead, not a knockout invasion.

By KEN KELLEY

Medium-duty imported trucks are doing rather well in the US market. A sales increase estimated by *AI* in the 7% range is nothing to be ignored at a time when the worldwide truck market has more than its share of soft spots.

However, the imports aren't doing so well when they face the inevitable comparison—how do they shape up against medium-duty (Classes 4-7; 14,001 lb-33,000 lb GVW) sales by the domestic producers?

The Motor Vehicle Manufacturers Assn. (MVMA) has released retail sales figures which show the domestics enjoying a sales gain of nearly 22%. The sales of domestic-badged, foreign-made mediums, such as Ford's Cargo models from Brazil and PACCAR's Volkswagen do Brazil-built trucks, are included in the MVMA tally but not in the *AI* import estimates, because they seem more 'domestic' than import to most people in the business.

Good response to new import models, many of which were introduced in the spring or early summer of 1988, is getting credit for much of the sales increase the foreign makes are enjoying. The foreign makes are doing well as niche marketers, offering specialized models that appeal to only small groups of truck users.

And several of the Japanese companies are predicting that they will be doing even better come next spring, when they will benefit from new specialized models added at the traditional introduction time in Japan.

This report is based on retail sales of foreign suppliers of medium-duty straight trucks: Hino, Isuzu, Mitsubishi Fuso and Nissan Diesel of Japan; Iveco, an offspring of Italy's Fiat, Mercedes-Benz of Germany . Where a manufacturer was willing to release actual sales figures, they were used. Other totals were estimated by *AI* based on 1988 model year sales so far.

Highly specialized models such as cutaway chassis on which delivery van bodies are mounted and tractors, products on which foreign makers are just now selling here, were not included.

A combination of manufacturers' sales figures and the estimates shows that medium duty sales of the six producers in the first nine months of this year totaled 8744 units, up 7.1% from the 8162 medium trucks moved in the comparable period of 1987.

MVMA's report on nine-month sales of medium models from the domestic producers and their overseas sources showed 1988 action at 142,086 trucks, up 21.8% from the 116,674 unit total for 1987.

The recent past has seen a rush to add models with GVW ratings like 32,600 lb and 32,900 lb, with several included in the spring 1988 additions.

Budget
PEPSI-COLA
SH SALAD BAR
FRUIT·DELI·GROCERY
COL

Left: Iveco trucks are now clustered toward the bottom of the medium-duty range. Middle: Sales to fleets are a major assist to foreign producers of mediums, such as Budget Rental's big purchase of Isuzus. Right: The Mercedes-Benz line relies heavily on short-nosed conventional trucks.

That's because a stiff federal excise tax on heavy trucks starts at 33,001 lb GVW. A truck with a 32,900 lb rating can do almost as much work and, without the excise, costs thousands of dollars less.

At this point, all medium-duty imports being discussed have at least one 32,000 lb model with the exception of Iveco which does not offer trucks in the light-heavyweight range in the US.

Domestic factories and their overseas sources also produce models that take a marketing advantage of this loophole.

Extreme specialization and tough competition characterize everything in the medium truck game. The imports made their original splash in Classes 4 and 5 because US producers had little in this size range and nothing with diesel power.

This has since changed. A very popular addition to the Ford line in 1987 was the F Super Duty, a Class 4 offering. A diesel-powered delivery chassis was added six months later.

Several of the Japanese marques are making big moves into Class 3, for light trucks with GVW ratings in the 10,001 lb-14,000 lb range. Formerly a preserve for US trucks, the class now has stiff Japanese competition—so much so that one import executive asked why Class 3 could not be included among medium trucks for purposes of this article. MVMA sets the classes for everyone.

Most of the import truckmakers hint that exciting new models are just around the corner but shy away from discussing details ahead of introduction time. Many of the hints indicate that more special models for niche markets are coming.

US Market Imported Medium-Duty Trucks

Maker	Model	Top GVW Rating (lb)
Hino	FB series	16,500
Hino	FD series	22,300
Hino	FE/FF series	30,000
Hino	SG series	32,900
Isuzu	NRR series	18,000
Isuzu	FSR	22,000
Isuzu	FTR	29,700
Isuzu	FVR series	32,900
Iveco	Euro 220 and Turbo	14,800
Iveco	Euroturbo 230	16,900
Iveco	Euroturbo 325/340	18,900
Iveco	Euroturbo 435/450	22,800
Mercedes-Benz	L-1117/L-1319	30,000
Mercedes-Benz	LP-1219/LP-1419	32,900
Mitsubishi-Fuso	FH 100	17,196
Mitsubishi-Fuso	FK 415	23,000
Mitsubishi-Fuso	FK 455	28,000
Mitsubishi-Fuso	FM 555	32,600
Nissan Diesel	UD 1800	17,640
Nissan Diesel	UD 2000	19,840
Nissan Diesel	UD 2600	26,000
Nissan Diesel	UD 2800	27,560
Nissan Diesel	UD 3000	29,760
Nissan Diesel	UD 3300	32,900
Volvo	FE6	30,000
Volvo	FE7	32,900

All above models are COE except L-model Mercedes, which are short-nosed conventionals.

Medium-Duty Imported Truck Nine Month Sales, 1988 vs. 1987

Company	1988	1987
Hino	1,555 *	1,460
Isuzu	1,506 *	1,081
Iveco	1,893	2,060
Mercedes-Benz	2,323	2,892
Mitsubishi-Fuso	2,150	1,084
Nissan Diesel	1,514 *	1,173
Volvo	1,259	1,476
Totals	10,941	9,750

*AI estimate

Things are a little different at Nissan Diesel America. They want to talk in hopes of getting the company name straight. This is the truck and diesel engine company which shares the Nissan name with the car company that also offers light trucks.

At Nissan Diesel America, Dale Weatherall, a spokesman, says the firm plans to add two new models in the spring of 1989. Both will fall in the GVW range already served by the line.

A hope, Weatherall says, is to carve out another successful niche such as the car-towing and recovery market in which some operators now use Nissans exclusively in fleets of 20 to 30 units.■

W THIEME SONS

Nissan Diesel America now calls all models in its growing line UD trucks.

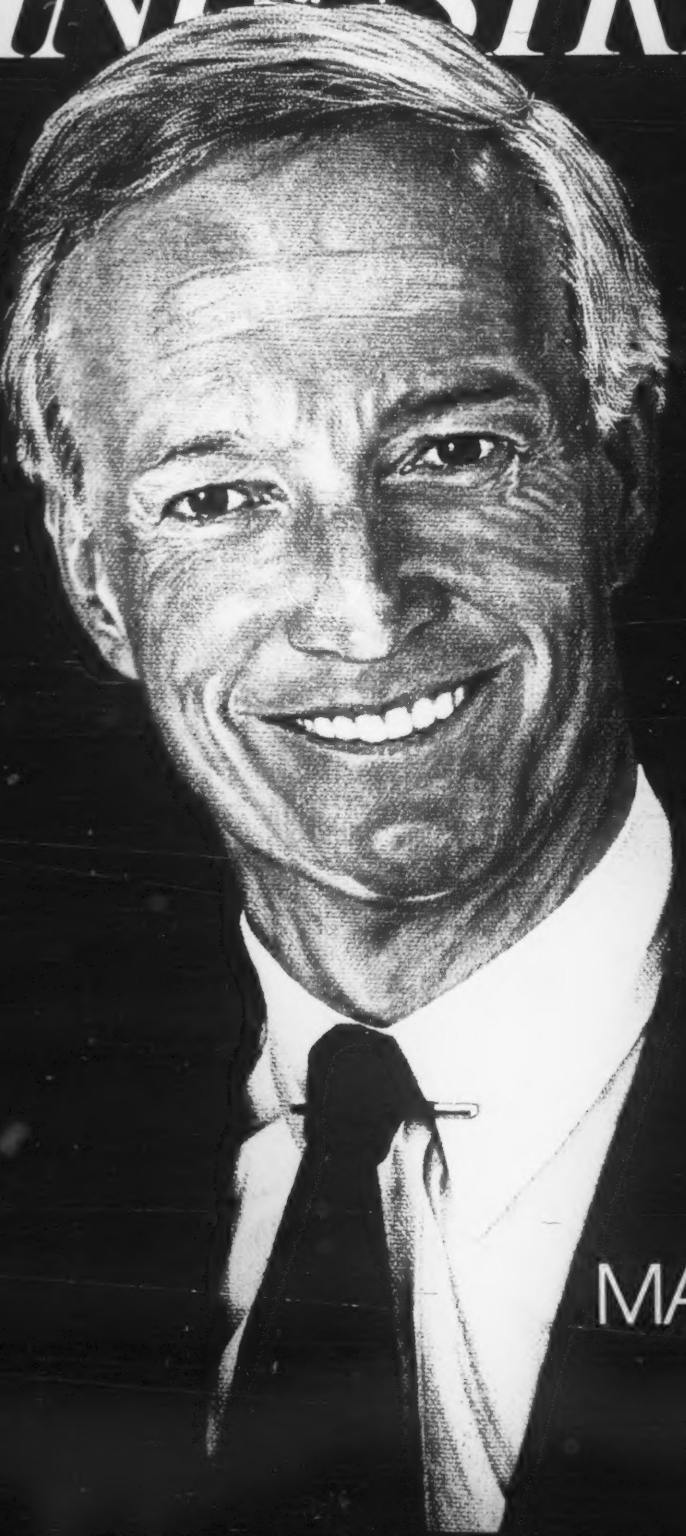
Urban delivery work is a prime application of the medium trucks from overseas, such as this Mitsubishi Fuso.

C2150-3
2/28/89

FEBRUARY 1989

CHILTON'S AUTOMOTIVE INDUSTRIES

SINCE 1895



1989 MAN OF THE YEAR

JOHN J. TELNACK
FORD VP, DESIGN

FEBRUARY 1989 VOLUME 169, No.2

CHILTON'S
AUTOMOTIVE
INDUSTRIES
SINCE 1895

Cover: With Jack Telnack leading the way, Ford's styling revolution continues to shake the industry. Read about our 1989 Man of the Year starting on page 52.

Cover art by Randy Hamblin.

COVER STORY

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Jack Telnack, Ford's VP of Design.

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*ONE OF THE **ABC PUBLISHING COMPANIES**, A PART OF **CAPITAL CITIES/ABC, INC.***

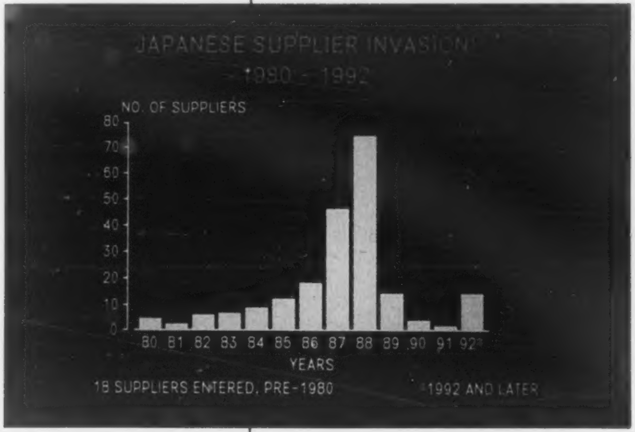
TORA, TORA, TORA!

232 Japanese supplier plants are gunning for your business.

by JOSEPH M. CALLAHAN

While the attention of the American media, public and government is focused on the six Japanese automotive assembly plants located in the US, a much more significant "invasion" is coming from Japanese auto suppliers. Many of these are owned or partly owned by the Japanese automakers.

The Japanese government has informed the US Commerce Department that 232 Japanese auto supplier plants are either now in production in the US or soon will be. And more are on the way.



Prior to 1980, only 18 Japanese suppliers were operating in America. But the number of new facilities starting production has increased every year since 1981. These start-ups really accelerated in the past two years, with 46 new operations starting in 1987 and a whopping 74 plants gearing up in 1988.

A list of those 232 plants follows, including the name of each parent company, the location of each plant, the products produced or to be produced, the customers, number of employees and year of production start-up. In some cases, all of this data was not available for each plant.

Included in the list are 26 joint-ventures, 36 proposed joint-ventures, 16 contemplated plants and 43 pending plants. The facilities that are pending and contemplated will undoubtedly materialize, because the Japanese government has announced that they are coming.

The Japanese government has agreed to supply this information to the US as the result of the MOSS (Market Oriented Sector Specific) trade talks between the US and Japan. MOSS was intended to increase the access of American companies to the Japanese market.

These talks have been almost total failures, except that the Japanese agreed to supply this data about their companies moving into the US automotive and numerous other American industries.

The influx of Japanese suppliers into the US supplier industry will undoubtedly be extremely successful. These facilities will surely demonstrate the admitted Japanese ability to produce both quality and competitively-priced parts.

They will also benefit from the plethora of concessions granted by the various states to new plants locating in those states, as well as other advantages, such as relatively low pension fund costs and the opportunity to use the latest technology.

In addition, Congresswoman Marcy Kaptur (D-OH), a leader in the fight to get fair treatment for American automotive suppliers, has charged that the Japanese companies have been assisted by various US government officials and that an "integrity" issue is involved.

While these 232 Japanese suppliers are ostensibly coming to the US to provide parts for the Japanese transplants, they'll certainly become major suppliers to the US Big Three. Eighty-five of these firms – a solid 36% – already have sourcing contracts with GM, Ford or Chrysler. Some have contracts with all three. AI

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
AP St. Marys #	Hitachi, St. Marys, OH	Aluminum Wheels	N/A	25	1988
AP Technoglass +	Asahi Glass/PPG Ind., Bellefontaine, OH	Auto Safety Glass	Honda	150	1985
ARCO/JSP Co. +	ARCO/Jap.Styren/ Mitsubishi Gas, Monaca, PA	Shock Absorp. Mat.	Nissan/Mazda/ Ford/GM	8	1986
ATC	Marubeni/Ube, Nashville, TN	Plastic Compounds	Nissan	3	1986
ATR Wire & Cable	Tokyo Rope/ Mitsubishi/C.Itoh, Danville, KY	Steel Cord/Bead Wire	Goodyear/Goodrich	636	1981
Aeroquip Automotive, Inc.	Yokohama Aeroquip Co., Japan, Van Wert, OH	Hoses, Fuel Lines, Oil Cooler Lines, Couplings, Tube Connectors	N/A	75	1987
Aeroquip *	Yokohama Rubber, Van Wert, MI	Hoses	N/A	N/A	1987
Aisin	Aisin Seiki, Seymour, IN	Brake Systems	GM/Ford	N/A	1989
Aisin USA	Aisin Seiki, Seymour, IN	Stampings	Toyota	100	1985
Aisin USA *	Aisin Seiki, Seymour, IN	Stampings	Toyota	100	1988
Aisin USA, Inc.	Aisin Seiki, Japan, Indianapolis, IN	Automotive mldngs	Toyota	250	1988
Aisin #	Aisin Seiki, Seymour, IN	Brake Systems	GM/Ford	N/A	1989
Alcan Toyo America *	Alcan Powder & Pigment/Toyo Alum., Joliet	Aluminum	N/A	30	1988
Alcoa Fujikura Rubber +	Fujikura Gomi Kogyo/Alcoa, Pittsburgh, PA	Wiring Harnesses	Ford	N/A	1986
Allen Bradley TDK +	Magnetics TDK Ltd./Allen Bradley, Shawnee, OH	Ferrite Magnets	US/Japan. Mfg.	300	1987
Alpine Electronics Mfg.	Alpine Electronics Japan, Greenwood, IN	Audio equip.	Amer. Honda/BMW	100	1987
Alpine Electronics Mfg.	Alps Electric Japan, Torrance, CA	Audio Equipment	N/A	125	1978
Ambrake Corp.	Akebono Brake Ind., Japan, Elizabethtown, KY	Disc Drum brakes	Honda, GM	100	1988
Ambrake Corp. *	Akebono Brake, Elizabethown, KY	Disk/Drum brake	Toyota	400	1988
American Koyo	Koyo Seiko Bearing, Orangeburg, SC	Ball/Roller Bearings	Ford/Chrysler	200	1975
American NTN Bearing Mfg. Corp.	NTN Toyo Bearing, Bearing, Elgin/ Schiller Pk., IL	Ball/Roller Bearings	GM/Chrysler	120/79	82/79

(Continued on p.92)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
American Shizuki	Shizuki Electronic Co., Japan, Ogallala, NE	File capacitors	GM/Ford/Chrysler	325	1942
American Yazaki Corp.	Yazaki of Japan, Canton, MI	Raw Components, Wiring Harness	Ford/Chrysler/ Nissan	200	1975
American Yazaki Corp.	Yazaki, El Paso, TX	Wiring Harnesses	Chrysler/Nissan	25	1984
Amtex Inc. +	Hayaski Telempu/ Masland, Manteca, CA	Floormats/Door Trim	NUMMI	50	1985
Arvin Sango, Inc. *	Sango/Arvin, Madison, IN	Mufflers	US Auto Co./Japan. Mfg.	195	1988
Askor Corp.	Union Sanyo, Japan, Peoria, IL	Oil, Air, Fuel Filters	N/A	3	1988
Asmo Co.	Asmo Co. Ltd., Japan, Battle Creek, MI	Wipers/Reser. tanks	Nippondenso	5	1987
Automotive Inc. *	Aeroquip Corp., Van Wert, MI	Hoses	N/A	N/A	1987
Azmo Co. Ltd. #	Azmo Co. Ltd., Statesville, NC	DC Motors	N/A	N/A	1989
Bando Mfg. #	Bando Chemical Ind., Bowling Green, Ky	Automotive belts	Toyota	40	1988
Bellenar Parts Ind.	Sanke Giken/ Tokyo Seat, Japan, Brussells Point, OH	Brake Lines, Door Sashes, Exhaust Sys., Catlyt. Conv.	American Honda	140	1985
Bellenar Parts Ind.	Sanke Giken/ Tokyo Seat, Japan,Marysville, OH	Seat Assemb./ Exhaust Sys.	American Honda	211	1982
Belletech +	Asahi Glass/ Takahashi, Bellefontaine, OH	Assembly Glass/ Trim	Honda	54	1986
Bendix-Jidosha Kiki *	Allied Bendix/ Jidosha Kiki, Gallatin, TN	Brake boosters	Japan./US Mfgs.	75	1987
Benteler Industries	Benteler Wisatechnik, W. Germ., Grand Rapids, MI	Sheet metal stamp/weld assembly	GM/Chrysler	150	1956
Bloomington Seat Co. *	Namha Press/ Douglas, Lomason, Normal, IL	Seats	Diamond Star	75	1988
Bridgestone USA	Bridgestone Ind. Ltd., LaVergne, TN	Truck/Bus Tires	Firestone/Aftmkt.	1100	1983
Bundy Int'l. *	Usui Int'l. Ind. Ltd./ Bundy, Bloomington, IL	Brake/Steel Tubing	Diamond-Star	50	1988
Bundy Int'l. +	Usui Int'l. Ltd./ Bundy, Cartersville, GA	Brake/Steel Fuel Tubing	Nissan	80	1984
Butler Polyset, Inc.	Guthrie Sanadian Inv. Ltd., Lenior, NC	Thermoplastics	Ford/GM	350	1980

(Continued on p.94)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
CCT #	N/A, Sydney, OH	Plastic Dies	Honda	N/A	1987
CKR Ind., Inc. +	Kinugawa Rubber/ Chardon, Rubber Winchester, TN	Weatherstrip	Nissan	41	1982
CME Corp.	Mitsuba Electric Mfg. Co., Japan, Mt. Pleasant, MI	Wiper Sys./Power Window Motors	N/A	8	1988
California Steel	Kawasaki Steel/ Rios/Doce, Fontana, CA	Steel Parts	Auto Parts Inc./ Wheelrims	850	1984
Calsonic	Nihon Radiator, Irvine, CA	Air Conditioning	Nissan	224	1976
Calsonic Mfg. Corp.	Nihon Radiator, Shelbyville, TN	AC/Exhaust Sys.	Nissan	433	1983
Calsonic Yorozu	Nihon Radiator Yorozu, McMinnville, TN	Metal Stamping	Calsonic/Nissan	100	1987
Calsonic Yoruzu *	Nihon Radiator/ GM, Shelbyville, TN	Stamped Parts	N/A	N/A	1988
Cast Forge +	Nippon Lt. Mtl./ Kelsey-Hayes, Howell, MI	Wheels/Transmissions	Mazda	100	1982
Central Mfg. *	Chou Seiki/Toyoda Am/Crtl Motor WI, Paris, KY	Wheels	Toyota/Nissan	50	1988
Central Michigan Electric *	Mitsuba Electric Mfg., Mt., Pleasant, MI	Windshield wiper sys.	N/A	N/A	1988
Clarion Corp. of of America	Clarion Co. Ltd., Japan, Walton, KY	Audio Equipment	Toyota	20	1988
Clarion Corp.	America Clarion Ind. Ind. Ltd., Nashville, TN	Audio Equipment	Chrysler/Nissan	N/A	1982
Clarion #	Clarion, Walton, KY	Car radios, stereos	Nissan	90	1987
Clevite-Bridgestone *	Bridgestone/ Clevite, Milan, OH	Rub. to Mtl. Prods.	Japa./U.S. Mfg.	12	1987
Color Composite	TechToyo Inc./ Mitsui Toatsu, Japan, Sidney, OH	Color conctrts/ Plastic comp.	Honda	16	1987
CoPar Int'l. #	Toyo Radiator/ CItoh/Long (CA), Hopkinsville, KY	Copper Radiators	Japanese Mfg.	100	1989
Curtis Maruyasu +	Maruyasu/Curtis Prod., Tracy, CA	Fuel Line/Brakes	NUMMI	25	1985
Curtis-Maruyasu	Maruyasu Kogyo, Japan, Lebanon KY	Gas/brake line tub. assembly	Nissan, Ford	2400	1988
Curtis-Maruyasu *	Maruyasu/Curtis Lebanon, KY	Fabricated Tubing	Toyota	30	1988
Daikin Clutch USA #	Daikin Mfg., Van Buren Twp., MI	Clutch/Clutch covers	Mazda	80	1990

(Continued on p.97)

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Delta USA #	Delta Kogyo, Monroe, MI	Seats	Mazda	180	1988
Diamond-Star Motors	Mitsubishi Motors, Bloomington, IL	Cars	Diamond-Star	100	1988
Diesel Kiki =	N/A, Decatur, IN	Air Conditioning	(BorgWnr) N/A	N/A	1988
Dunlop Tire	Suritomo Rubber, Huntsville, AL	Auto Tires	Honda/Aftermarket	800	1986
Eagle Wings Ind.	Nippon Eagle Wing Wing Ind., Japan, Rantoul, IL	Underbody parts	Diamond-Star	N/A	1988
Enkei America #	Ebsgu Keigokin/ Mitsubishi, Columbus, IN	Aluminum Wheels	Ford/Chrysler/GM	70	1987
Enpac *	GNB Inc./Japan Storage Battery, Memphis, TN	Storage Batteries	US/Japanese Mfg.	175	1988
FEC Incorporated	Daiichi Dentsu, Japan, Madison Heights, MI	Elec. fastening sys.	Ford/GM	30	1983
Firestone *	Bridgestone/Japan, Japan, Chicago, IL	Tires	Japan./US Mfg.	50,000	1988
Fuji Koki America	Fuji Koki Co. Ltd. Dallas, TX,	A/C, Thermostats	Toyota/Honda	35	1982
Fujitsu Ten #	Fujitsu Ten Rushville, IN	Audio Components	N/A	50-75	1987
Fuso Light Alloys =	N/A	Die Cast Parts	Japan. Auto Mfg/US	N/A	1988
GECOM #	Mitsui Mining & Saltng., Greensburg, IN	Door locks/ handles	Honda	150	1987
General Seating of America *	NHK Spring/Lear Siglas, Lafayette, IN	Car Seats	Subaru/Isuzu	N/A	1988
Greenville Technology	Mariroku Co., Ltd, Japan, Greenville, OH	Plastic Inj. Molded Parts	Honda	86	1987
Greenville Technology Morirku *	Capitol Plastics Marysville, OH	Plastic Comp.	Honda	N/A	1987
Heartland Automotive #	Shigeru Ind. Ltd. Greencastle, IN	Interior parts	Japanese Mfg.	N/A	1989
Hi-Lex Corp.	Nippon Cable Systems Inc., Battle Creek, MI	Control Cables	Ford/Chrysler/ GM/Nissan	175	1978
Hi Flo	Toray Industries Japan, Northwood, OH	Int.Door Pan./ Pl. Mold	Mazda	25	N/A
Hisan	ITT Higbie, Japan, Findlay, OH	Brake Line Tubing	Nissan/Honda/ Mazda	20	1988
Hisan *	ITT Higbee/Sanoh Ind. Corp., Archford, OH	Brakes/coating/ binding	Honda/Nissan	N/A	1987

(Continued on p.98)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Hisan, Inc.	Sanah Industrial Co. Co. Ltd., Japan, Rochester, MI	Tubing	GM/Ford/Chrysler	135	1936
Hitachi Auto. Prod. (USA) Inc.	Hitachi Ltd., Japan Harrodsburg	Ignit. Cls. Elec. Auto Equip.	Ford/Chrysler/ GM/Nissan	80	1986
Hitachi Electric Wire #	Hitachi, New Albany, IN	Rubber hoses	Japan./US Mfg.	35-150	1988
Hitachi Magnetics Corp.	Hitachi Metals Ltd., Edmore, MI	Permanent Magnets	GM/Ford/Aftmkt.	400	1973
Honda All Lock *	Honda Corp./All Lock Corp., Selma, AL	Car Locks	Honda	N/A	1988
Honda USA #	Honda, Anna, OH	Engines	Honda	800	1988
Honda of America Mfg.	Honda Motor Co., Japan, Marysville, OH	Auto Assem./ Metal Stamp	Honda	3900	1982
I.I. Stanley #	Stanley/Kyokuto/ Stanley US, Battle Creek, MI	Auto. Elec.Comp.	Japanese Mfg.	N/A	1987
I/N Tek. *	Nippon Steel/ Inland Steel, South Bend, IN	Cold Rolled Steel	Japan./U.S. Mfg.	N/A	1990
INOAC #	Inous, Bardstown, KY	Exterior trim	N/A	91	1988
Ichikoh Mfg. #	Ichikoh Ltd., Shelbyville, KY	Automotive Lighting	Nissan	90	1988
Idemitsu Chemicals USA =	Idemitsu Petrochemicals, N/A	Compound Resins	GM/Ford	N/A	1988
Ikeda Interior Sys.	Ikeda Busan Co. Ltd., Mufreesboro, TN	Interior Parts	Japan./US Mfg. Nissan	30	1987
Ikeoa Bussan =	N/A	Seats/Interiors	Nissan/US Auto Co.	N/A	N/A
Inoac USA, Inc.	Inoue MTP Co. Ltd., Bardstown, KY	Exterior parts, trim, foam	N/A	91	1988
Isuzu Motors	Isuzu Motors, Japan, Patchoque, NY	Steering wheels	Big 3/Nissan/Mazda	250	1977
Izumo Corp.	Isumi Motors, Yaphank	Steering Wheels, Horns, Pad Assemb.	Ford/Chrys/Nissan/ Mazda/AMC	250	1979
Jideco #	Jidosha Denki, Kogyo Co. Ltd., Bardstown, KY	Wiper Mtrs/Cruise Control	Nissan	100	1987
KTH Parts Ind., Inc.	Takao Seisakusho/ Honda, Japan, St. Paris, OH	Mtl Stamp./Weld.	Honda	264	1985
KYB Industries #	Kayaba Industries Franklin, IN	Shock absorbers	US/Japan. Mfg.	70	1989
Kantus Corp.	Kanto Seiki, Lewisburg, TN	Plastic Inst. Pnls.	Nissan	150	1983
Kecy Products *	Homer Donaldson/ Kitsuda Engrg., Hudson, MI	Engine/seal/parts	Mazda/Honda	6-8	1988

(Continued on p.101)

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Kobelco of America, Inc. #	Kobe steel/Nissho Iwai/Shinsho, Seymour, IN	Steel Powder	Japan./US Mfg.	N/A	1989
Kokoku Rubber	Kokoku Ltd., Richmond, KY	Auto Components	Toyota	50	1988
Koyo Metal #	Koyo Metal Co. Ltd., Ltd. Battle Creek, MI	Extruded Alum. Parts	N/A	N/A	N/A
Koyo Seiko =	N/A	Steering Systems	N/A	N/A	N/A
Kux Mfg.	Mitsubishi Detroit, MI	Pinstripping/ Lettering	GM/Ford/Chrysler/ Toyota	3500	1985
LS Electro Galvanizing +	Sumitomo Metal/LTV Cleveland, OH	Galvanized Steel Sheet	US/Foreign Mfg.	75	1986
Le Blond Makino Machine	Makino Milling Co., Ltd., Japan, Cincinnati, OH	Tools, flexible aft. syst.	American Honda/ GM	455	1981
Lenawee Stamping #	Kuroihi Tekko/Mura Mura, Kogyo Lenawee, MI	Stampings	Mazda/Ford	N/A	1989
MBL #	Mitsubishi Belt, Ottawa, IL	Drive belts	D-S/Toyota	125	1988
MTM Bower Co.	MTM Toyo Bearing Co., Japan, Macomb, IL	Bearings	Big 3	500	1986
Maruyasu Kogyo =	N/A, Kentucky	Steel tubing	Toyota	N/A	N/A
Mason Melco Mfg.	Mitsubishi Electric, Japan, Ohio	Generators and Alternators	N/A	60	1988
Matsushita Comm. #	Matsushita Comm., Peachtree, GA	Car Audios	Mazda	30	1987
Mazda Motor Corp.	Mazda Motor Mfg. Corp., Japan, Flat Rock, MI	Cars	Mazda (MX-6) Ford (Probe)	1400	1987
Mid-West Mold	Tatematsu Mold, Japan, Batavia, OH	Plastic injec. molds	N/A	30	N/A
Mitsubishi Air Conditioning Div.	Mitsubishi, Los Angeles, CA	Air Conditioning	Diamond-Star	N/A	1987
Mitsubishi Belting Co. Ltd. Japan	Mitsubishi Belting Co., Ottawa, IL	Belts, hoses	N/A	110	1988
Mitsubishi Electric Co. #	Mitsubishi Electric, Mason, OH	Electrical Parts	Japan./US Mfg.	200	1988
Mitsubishi Heavy Ind.	Mitsubishi Heavy Ind., Japan, Rancho Dosinquez, CA	A/C Sys. Subassemblies	Mitsubishi/Chrysler	10	1987
Mitsubishi Metals #	Mitsubishi Metals, Columbus, IN	Powdered metal eng. parts	Japan./US Mfg.	N/A	1989
Mitsubishi Reactive +	Mitsubishi/Reactive Metals, West Pittsburg, PA	Magnets	GM	5	1986
Miyachi Denshi #	Miyachi Denshi, Columbus, OH	Automotive Welding	N/A	N/A	1988

(Continued on p.102)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Molton-BRC *	Molten Japan/BRC Circa Fort Wayne, IN	Rubber Molded Parts	Mazda	N/A	1988
Morton Yokohama *	Yokohama Rubber/Morton Thiokol, Ringwood, CA	Windshield Sealants	Japanese Mfg.	10	1988
Musashi USA #	Musashi Seimitsu, Battle Creek, MI	Suspension/ Steering	Ford	40	1987
N/A =	Fuji Heavy Industries, Tippecanoe Ct., IN	Engines	Subaru/Isuzu	N/A	1988
N/A =	Japan Storage Battery GNB Inc., Memphis, TN	Batteries	Orig./ Replace. Market	N/A	1989
N/A =	Mitsubishi/Exxon, Baytown, TX	Plastic Based Comp. Material	Japan. Auto Mfg./US	N/A	N/A
N/A =	Nihon Yoruzo, Tennessee	Pressed Parts	Nissan	N/A	1987
N/A =	Tsuchiya Schleigel, Bloomington, IN	Weather Stripping	N/A	N/A	1988
N/A =	Yokohama Tire/ ~~Toyo/~~Continental Genl, Mt. Vernon, IL	Tires	N/A	N/A	1989
NDK, Inc.	Nippon Oil Seal Co., Ltd., Japan La Grange, GA	Oil Seals, Mech. Seals	Big 3/Navistar	326	1980
NHK Associated Spring	NHK Spring Co. Ltd., Bowling Green, KY	Coil springs for suspens.	Nissan	26	1987
NKC America Inc.	Nakanish Metal Works Co., Ltd., Memphis, TN	Conveyor Equip.	GM/Chrysler/ Nissan	50	1984
NKC America, Inc.	Nakanishi Metal Works, Japan, Memphis, TN	Conveyor equip./ Transfer equip.	Nissan/Chrysler	100	1980
NOK	Nippon Oil Seal LaGrange/Braselton	Oil & Mech. Seals	Ford/GM/Chrys/ Navistar	N/A	1980
NSK	Nippon Seiko K.K., Clarinda, IA	Ball Bearings	GM/Ford/Chrysler	210	1976
NSK Corporation	Nippon Seiko K.K., Japan, Ann Arbor, MI	Bearings	Ford/Chrysler	302	N/A
NTN Bower +	NTN of Japan/ Federal Mogul, Hamilton, AL	Bearings/Heavy Duty Veh.	US/Japan. Mfg.	400	1985
National Steel 50	N/A, Canton Township, MI	Blanks/Stamping Oper.	GM	N/A	1988
National Steel, Great Lakes Div. +	Nippon Kokan/ National City, Detroit, MI	Cold/Hot Steel	US Mfg.	4500	1984

(Continued on p.105)

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
National Steel, Granite City Div. +	Nippon Kokan/ National Steel, Granite City, IL	Cold/Hot Steel, Coated Sheet	US Mfg.	3422	1984
National Steel, Midwest Portage Div. +	Nippon Kokan/ National Steel, Portage, IN	Cold/Hot Steel	US Mfg.	1700	1984
Neaton Automotive Products	Nihon Plastics, Eaton, OH	Steering Wheels	Honda/Nissan	168	1986
New Sabina Industries	Nippon Seiki, Japan, Japan, Sabina, OH	Instru. Panels, Speedometers	Honda	80	1987
Nifco *	Nifco Hillard, OH	Rubber Parts, Radiator Hoses	Honda	100	1988
Nihon Sheet Glass =	N/A, Illinois	Soundproofing	N/A	N/A	1988
Nippon Pigment USA	Nippon Pigment Co. Co., Ltd., Houston, TX	Color Compounds	N/A	16	1985
Nippon Sheet Glass =	N/A, Kentucky	Automotive Glass	N/A	N/A	1988
Nippondenso	Nippondenso, Long Beach, CA	AC, Alternators	Toyota	250	1971
Nippondenso	Nippondenso Ltd., Marysville, TN	Alternators/Starters	Nissan	550	1991
Nippondenso, 2 fac. =	N/A, Midwest	Elect. Comp./ Air Compr.	N/A	N/A	1988
Nippondenso Mfg. USA Inc.	Nippondenso Co. Ltd. of Japan, Battle Creek, MI	Condensers/ Evaporators	Toyota/Mazda/ Honda	400	1986
Nishikawa-Standard *	Nishikawa/ Standard Products, Topeka, IN	Sponge Rubber	Japanese Auto Co. in US	200	1987
Nissan	Nissan, Smyrna, TN	Engines	Nissan	N/A	1991
North American Lighting, Inc.	Koito Mfg./ Ichikoind/ Wstflsch Mtl. Flora, IL	Automotive Lighting	N/A	N/A	1983
Nova Steel Processing +	C. Itoh/Armco Steel, Steel, Tipp City, OH	Processing Steel	GM/Ford	45	1986
Ogihara America Corp. #	Ogihara Iron Works, Works, Howell, MI	Auto parts, stamping	Ford/GM/ Chrysler/Mazda	50	1987
Oiles America #	Oiles Industry, Plymouth Twp, MI	Auto Parts Machinery parts	Ford/GM/Chrysler	8	N/A
Omega Tube Conduit Co. #	Sumitomo Metal Ind. Ltd., Little Rock, AR	Steel pipe stabilizers	N/A	N/A	1987
Ondo Kosaku-/ shu Yamamoto Kozail	M-Tex Kasai Kogyo Kogyo Co., Ltd., Manchester, TN	Door Trim	Nissan/Honda	80	1987
Optec Dai-ichi Denko #	Optec Baitich Denko, Mexico	Magnetic Wire	Ford/Chrys/ GM/Toyota	N/A	1987

(Continued on p.107)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Ortech *	Yuhshin/Orschein Indiania/Missouri	Elect. Auto Parts	Japan./US Mfg.	250	1986
Penstone +	Ishizaki Honten/ Nippon, St. Gl., Ford, Rockwood, MI	Automotive Glass	Japan./US Mfg.	100	1987
Pioneer Ind. Components Inc.	Pioneer Electronic, Springboro, OH	Auto. Elect. Audio Equip.	N/A	50	1986
Pop Industries +	Fujikura Ltd./Alcoa Ripley and Houston, MS	Automobile Wire Harnesses	N/A	N/A	1986
Precision Seals Co.	IFI Int'l., SA Luxenbourg, Castonia, NC	Oil Seals	N/A	350	1966
Pro Coil Corp. *	Marubisi Group, Canton Twp, MI	Blanks/Stamping Oper.	GM	50	1988
Recticel Foam Corp.	PRB, Belgium, Morristown, TN	Seats	Big 3	358	1960
Sanden Int'l. USA	Sanden Corp. of Japan, Dallas, TX	A/C Compressors	Volkswagen	180	1980
Sanoh Ind. =	N/A, Michigan	Surface Treatments	N/A	N/A	1988
Sanyo Machine =	N/A, Michigan	Welding Equip.	N/A	N/A	N/A
Sheller Ryobi *	Ryobi/Sheller Globe, Shelbyville, IA	Transmission Housings	N/A	N/A	N/A
Shiroki/Wickes *	Shiroki/Wickes, Gordonsville, TN	Window Regulators	US/Japan. Mfg.	25	1988
Showa Aluminum #	Showa Aluminum Sterling, MT	Aluminum Heat Exchangers	N/A	200	1987
Showa Mfg. #	N/A, Sunbury, OH	Shock Absorbers	Honda	N/A	1988
Sintering Technologies *	Hitachi Powdered/ Metals/Cummins Engine, Greensburg	Sintered Metal Parts	Cummins/Chrysler	140	1988
Stanley Electric Co.	Stanley Electric Ltd., London, OH	Auto Light	Honda	100	1981
Sterling INOAC *	Inoue MTP/Sterling Sterling, Engrd., Mt. Clemens, MI	Molded Parts	Nissan/Mazda	10	1988
Subaru-Isuzu	Fuji Heavy Industries, Japan, Lafayette, IN	Auto/truck assemb.	N/A	1700	1989
Sumitomo #	Sumitomo Wiring Systems Ltd., Morgantown, KY	Wiring Harnesses	Mazda	50	1987
Sumitomo Heavy Industries	Sumitomo Chesapeake, VA	Drives/ Transmissions	N/A	100	1988
Sumitomo *	Sumitomo Wiring Systems Ltd., Morgantown, KY	Wiring harnesses	Mazda	5087	1987
T.D. Manufacturing	Toyo Denso, Japan, Hillsboro, OH	Electric Auto Parts	N/A	100	1988

(Continued on p.108)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
TG USA Corporation #	Toyoda Gosei/ Mitsui, Perryville, MO	Steering Wheels	Ford/Chrys/ GM/Toyota	30	1987
TRW/Fuji Valve =	Fuji Valve/TRW, N/A	Engine Valves	Honda	N/A	1989
TRW/Koyo Steering Systems =	Koyo Seiko/TRW, N/A	Gears	Japan./Asian Mfg.	N/A	1989
TS Trim Inc. #	Sankei Giken Kogyo Kogyo, Tokyo Seat, Canal Winchester, OH	Door Sashes/ Pipes	Honda	N/A	1988
Takata-Fisher +	Takata, St. Clair Shores, MI	Assemble Seat Belts	Honda/Nissan	50	1985
Techno Trim Inc. +	Tachi-S Ltd./ Johnson Controls, Stockton, CA	Seat Covers	NUMMI	N/A	1987
TechnoTrim *	Tachi-S Ltd., Johnson Controls, Maysville, KY	Seat Covers	Honda	N/A	1988
Teikuro #	N/A, Springfield, OH	Chrome Plated stamp dies	Honda	N/A	1988
Tenex Ind.	Tsuchiya Mfg., Murfreesboro, TN	Air cleaner/ Elements	Nissan	45	1988
Thermalex Inc. +	Mitsubishi Alum./Thermal Comp., Montgomery, AL	Aluminum Extrusion Products	N/A	30	1986
Tokai Corp. #	Tokai Rubber Ind. Ltd., Livonia, MI	Shock Absorbers	Ford	120	1987
Tokai Rika =	N/A, Kentucky	Electrical Equipment	Toyota	N/A	1988
Tokico America Inc. #	Tokico Ltd., Berea, KY	Automotive shocks	Ford	150	1988
Tokico America, Inc.	Ichikoh Ltd., Shelbyville, KY	Automotive Lighting	Nissan	90	1988
Tokico Ltd.	Tokico Ltd., Japan, Japan, Berea, KY	Shock absorbers	Toyota	80	1988
Tomazco Milciber #	Masuda Mfg. Co. Ltd., Columbus, OH	Stamped Parts	Honda	40	1987
Topy Corp.	Topy Industries Ltd., Frankfort, KY	Wheels	Nissan/Honda	94	1986
Toyo Seat #	Toyo Seat, Imlay City, MI	Car Seat Parts	Ford	N/A	N/A
Toyoda Machinery =	N/A	Machine Tools	N/A	N/A	1990
Toyota	Toyota, Georgetown, KY	Engines/Axles/ Steering Sys.	Toyota	500	1988
Toyota Motor Corp.	Toyota Motor Corp., Japan, Georgetown, KY	Auto assembly	Toyota	270	1988
Toyota Synthetics =	N/A, Missouri	Plastic Parts	Japan./US Mfg.	N/A	1988

(Continued on p.110)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Toyota #	Toyota, Georgetown, KY	Engines/Axles/ Steering sys.	Toyota	500	88/89
Tri-Con	Tokyo Seat Co., Cape Birardeau, MO	Seat Covers	Chrysler	275	1983
Tri-Con	Tokyo Seat Co., Columbia, MO	Automotive Seats	Chrysler	130	1983
Tri-Con	Tokyo Seat Co., Lincoln, NE	Motorcycle Seats	Kawasaki/Honda Chrylser	50	1978
Trim Masters *	Arakawa Autobody, Hoover Universal, Lexington	Seat Covers	Toyota	N/A	1988
Trinity Industrial Corp.	Trinity Industrial Corp., Georgetown, KY	Paint	Toyota	40	1986
Trinity Industrial Corp.	Trinity Industries Corp., Japan, Georgetown, KY	Auto spray painting syst., paint	Toyota	15	1987
Trinity Industrial Corp. *	Trinity Industrial Corp., Georgetown, KY	Paint	Toyota	40	1988
Truetec #	Daifuku, Urbana, OH	Painting/Plastics	N/A	N/A	1988
U.G.N. Inc./United Glove Nippon Inc*	Uni-NTS/Globe Ind., Ind., Chicago Hgts., IL	Sound Absorp Mat.	Japan./US Mfg.	45	1987
US Engine Valve *	Niton Valve, Westainster, SC	Engine Valves	Japanese Mfg.	125	1988
United Globe Nippon Co.	Fujiyoshi/Hirotoni/ Nihon/Globe, Chicago Hts. IL	Auto. Sound Controls	Honda/NUMMI/ Toyota/Mazda	80	1987
United L-N *	Libby-Owens Ford/Nippon Sheet Steel, Versaille, KY	Automobile Glass	GM, Japan./US Mfg.	400	1987
Ushio Denki #	Ushio Denki, Newburg, OR	Halogen Lamps	N/A	50	N/A
Usui =	N/A, Michigan	Plastic Fans	N/A	N/A	1990
VDO-Yazaki Corp.	Yazaki Sogyo/VDO Winchester, VA	Instrumentation	GM/Chrysler	350	1987
Viam	JapanVilene/ Dainippon I&C, Santa Fe Springs, CA	Floor Mats	Toyota/Honda/GM/ Chrys/Aftmkt.	120	1984
Vuteq #	Chubu Ind., Georgetown, KY	Automotive windows	Toyota	20	1988
WTN Bower +	NTN/Federal Mogul, Macomh, IL	Bearings/Heavy Duty Veh.	US/Japan. Mfg.	300	1985
Warner-Ishi +	Ishikawajima/ Borg Warner, Shelbyville, IL	Automotive Turbochargers	Ford	N/A	N/A
Warwick Steel Co.	Nissho Iwai, Columbus, OH	Slit Steel/Stights	GM	113	1985

(Continued on p.112)

JAPANESE SUPPLIERS

COMPANY	PARENT/LOCATION	PRODUCT	CUSTOMER	EMPLOYEES	STARTUP
Weastec #	Toyo Denso, Hillsboro, OH	Plastic/Wire parts	Honda	500	1988
Wheeling Nisshin, Inc. *	Nissan Steel, Follansbee, WV	Galv/Alum. Steel	US Mfg.	200	1989
Woodbridge INOAC #	Woodbridge Canada Inoue Bardstown, KY	Instrument panel	Ford/Diamond-Star	119	1988
Wynn-Kiki Inc. +	Diesel-Kiki/Wynn Industries, Fort Worth, TX	A.C. Compress./ Evap.	Honda/Nissan	128	1984
Yamakawa Mfg. Corp.	Yamakawa, Portland, TN	Pressed Parts	Nissan/Japan./ US Mfg.	80	1988
Yuasa General Battery Corp. +	Yuasa Battery/ General Battery, Reading, PA	Motorcycle Batteries	N/A	211	1977
Yuhshin =	N/A, Michigan	Switches/Instmnts./ Steering Locks	Japan. Auto Mfg./US	N/A	1988
Yuma Ind. *	Yushiro/Master Ind., Ind., Shelbyville, IN	Metal Working, Oil/Fluids	Japan./US Mfg.	N/A	1987
Yusa Corp. *	Lord Corp./ Yanashita, Union Twp., OH	Rubber Parts, Radiator Hose	Honda	100	1988

(+) – Joint Ventures with US Partners in Auto Parts Manufacturing Facilities in the United States.
(*) – Pending Joint Ventures in Auto Parts Manufacturing Facilities in the United States.
(=) – Contemplated Auto Parts Manufacturing Facilities.
(#) – Pending Japanese Auto Parts Manufacturing Facilities in the United States.

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AUTOMAKER QUARTERLY REPORT

Big Three gain market share for '88, but Accord outsells Escort.

by Dr. THOMAS O'GRADY

As 1989 begins, we still see no end in sight for incentives which, along with emphasis on performance and quality, helped the Big Three domestics increase their passenger car market share in '88.

GM improved its passenger car selling rate during fourth quarter '88 by two percentage points, thus lowering its total 1988 market share loss to 36.1%, from 36.5% in 1987. Ford's share was up 1.8 points for the quarter and 1.5 points for the year.

Chrysler's fourth quarter car sales were restricted because of some product line changes, but they still gained .5 points of share over the year.

Dr. Thomas O'Grady heads Integrated Automotive Resources, Inc. in Wayne, PA.

Many small car lines lost sales during fourth quarter 1988, while more compact-sized models climbed the Top 10 chart. Although Ford's Escort remains America's best-seller for '88, the Honda Accord captured the top sales spot during the last quarter. Toyota's Camry is likely to gain more sales now that it's built in Georgetown, KY.

Many of the smaller Japanese companies are struggling with image problems, but even Honda and Toyota declined in share in the fourth quarter. The Japanese plan to improve their position in 1989 with increased North American production, new products and more movement upmarket.

Sales of European cars, which suffered all year from the weak dollar and high prices, did not recover during the fourth quarter. The "other" imports, from Korea and Brazil, increased market share, but we see some early signs of weakness. Many planned introductions from Third World and Eastern Bloc countries were recently canceled because of unexpected cost and labor problems. Also, the Hyundai Excel has disappeared from the US Top 10 list, possibly due to production problems and difficulties in penetrating the compact car markets.

WHAT'S HOT! Domestic Auto Sales 4th Quarter 1988

Carline	'88	'87	% Change
Accord	99,147	98,604	0.55%
Escort	93,205	86,720	7.48%
Taurus	87,710	80,410	9.08%
Cavalier	75,852	71,394	6.24%
Corsica/Beretta	72,874	47,896	52.15%
Camry*	69,088	58,092	18.93%
Tempo	68,445	47,852	43.03
Celebrity	59,911	65,651	(8.74%)
Corolla*	59,541	46,120	29.10%
Grand Am	58,390	48,818	19.61%

* – Includes imports
( ) – Negative value

US Passenger Car Market Shares, 4th Qtr. 1988

Manufacturer	Sales	% Total
General Motors	880,698	35.34%
Ford	538,626	21.61%
Chrysler	272,170	10.92%
Honda/Acura	204,948	8.22%
Toyota	195,805	7.86%
Nissan	105,771	4.24%
Hyundai	55,316	2.22%
Mazda	52,884	2.12%
Subaru	39,529	1.59%
VW/Audi	30,748	1.23%

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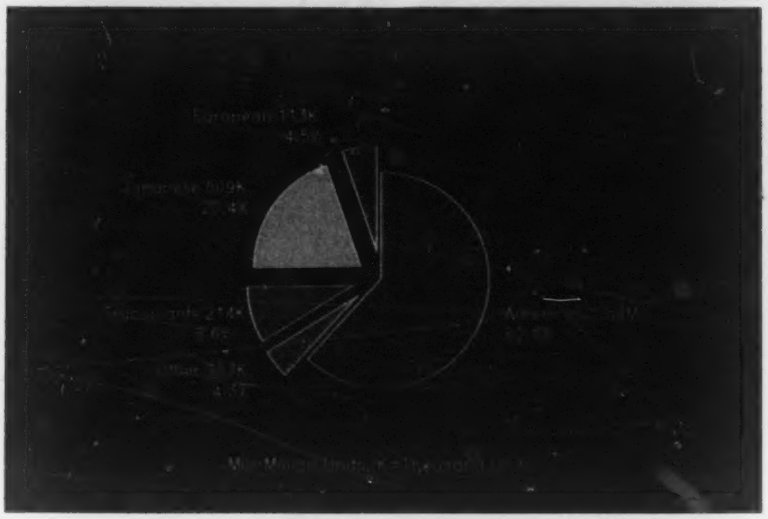


Passenger Car Market Share By Geographic Base

Fourth Quarter 1988

Manufacturers	Total Sales	Total Market Share
American	1,548,266	62.13%
Japanese	509,143	20.44%
European	113,196	4.54%
US-Built Imports (Honda,NUMMI, Nissan, Mazda)	213,958	8.59%
Other Imports	107,175	4.30%
Total	**2,492,028**	**100.00%**

4TH QUARTER 1988 DOMESTIC LIGHT TRUCK PRODUCTION

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 1988	TOTAL 1987
FORD	171,774	67,964	67,720	53,682	18,322	27,856	403,918	403,318
CHEVROLET	148,897*	66,592	32,759	42,280	33,718	46,722	305,489	370,968
CHRYSLER	28,719	28,732	30,026	112,724	6,157	—	197,343	206,358
GMC	50,409*	16,247	11,521	10,857	10,641	13,203	93,492	112,878
JEEP	—	9,698	—	—	4,057	67,763	62,528	81,518
NISSAN	—	24,908	—	—	—	—	35,206	24,908

*Includes Suburban and P-model

INDUSTRY JOURNAL

Rentals Hurting Con Equipment Makers

by John Stark

Construction machinery rental may be big business to some dealers in the southeastern US and western Canada, but some nameplate manufacturers aren't too thrilled about it.

According to certain vehicle producers, construction rental is poor business strategy. Rental machinery—many of it brand-new from the factories—could devalue the sticker price of new vehicles sitting on dealer lots.

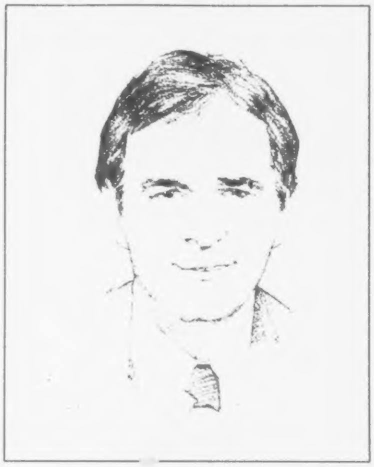
Some construction machinery makers have taken disciplinary action to slow down the explosive growth of rental fleets. But it hasn't slowed.

Contractors continue to opt for rentals at a fast clip to hedge against rising interest rates and uncertain near-term business conditions.

"Since 1985, the number of units in the rental fleets of (construction machinery) dealerships, as well as the value of the equipment, have increased dramatically," says Lawrence J. Pelka, executive VP of Associates Commercial Corp., the largest financier of construction and mining machinery acquisition in the US.

A survey of nearly 200 managers of US construction machinery dealerships by Associates Commercial, a commercial finance unit of Associates Corp. of North America, reveals several key developments since 1985:

- A rise in contribution of new machinery sales to dealership revenue;
- A slip in contribution of new machinery sales to overall dealership profitability;
- An increase in contribution of aftermarket business to dealership profitability;
- A sharp advance in the actual number of construction machines stocked in dealership rental fleets.



John Stark is editor and publisher of Stark's Off-Highway Ledger.

In other words, unit sales rebounded during the past three years, but profit margins narrowed as dealers cut prices on new vehicles to close deals. Part of the last margins were apparently recouped *via* expanded aftermarket activity and greater reliance on rental equipment revenue.

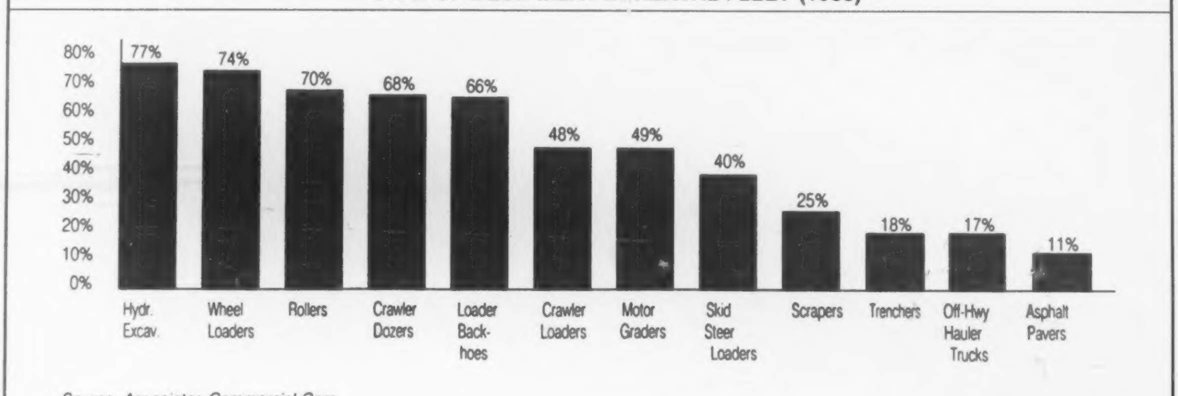
"The average equipment dealer rental fleet now has 213 pieces of equipment in service, up 22% from 174 pieces that dealers averaged in 1985," Pelka says. "Only 10% of all distributors have no rental equipment, down from 14% [in 1985]."

The level of utilization among construction equipment distributorship rental fleets is much lower than in related markets such as trucking, which often runs to 90% leasing, adds Pelka. Construction machinery rental activity was highest in the southeastern US at 69% and lowest in the Midwest at 50%. According to Associates Commercial, 38% of the average dealer revenues resulted from new machinery sales (up just 2% from 1985). Aftermarket activity generated 26% of revenue. Used equipment sales and rentals stood at 18% and 16%, respectively.

Construction machinery industry insiders believe the discrepancy of a nominal 2% advance in revenue *via* sales of new machines, compared to as much as a 19% gain in US retail unit turnover last year, is a sure sign that dealers continue to place factory-ordered vehicles into their own rental fleets and turn the machines over to renters at discount prices.

Far too many construction equipment distributors have not set up policies and procedures to effectively manage rentals. But equipment manufacturers remain concerned about nameplate devaluation and its impact on competitive pricing.■

TYPE OF EQUIPMENT IN RENTAL FLEET (1988)



Source: Associates Commercial Corp.

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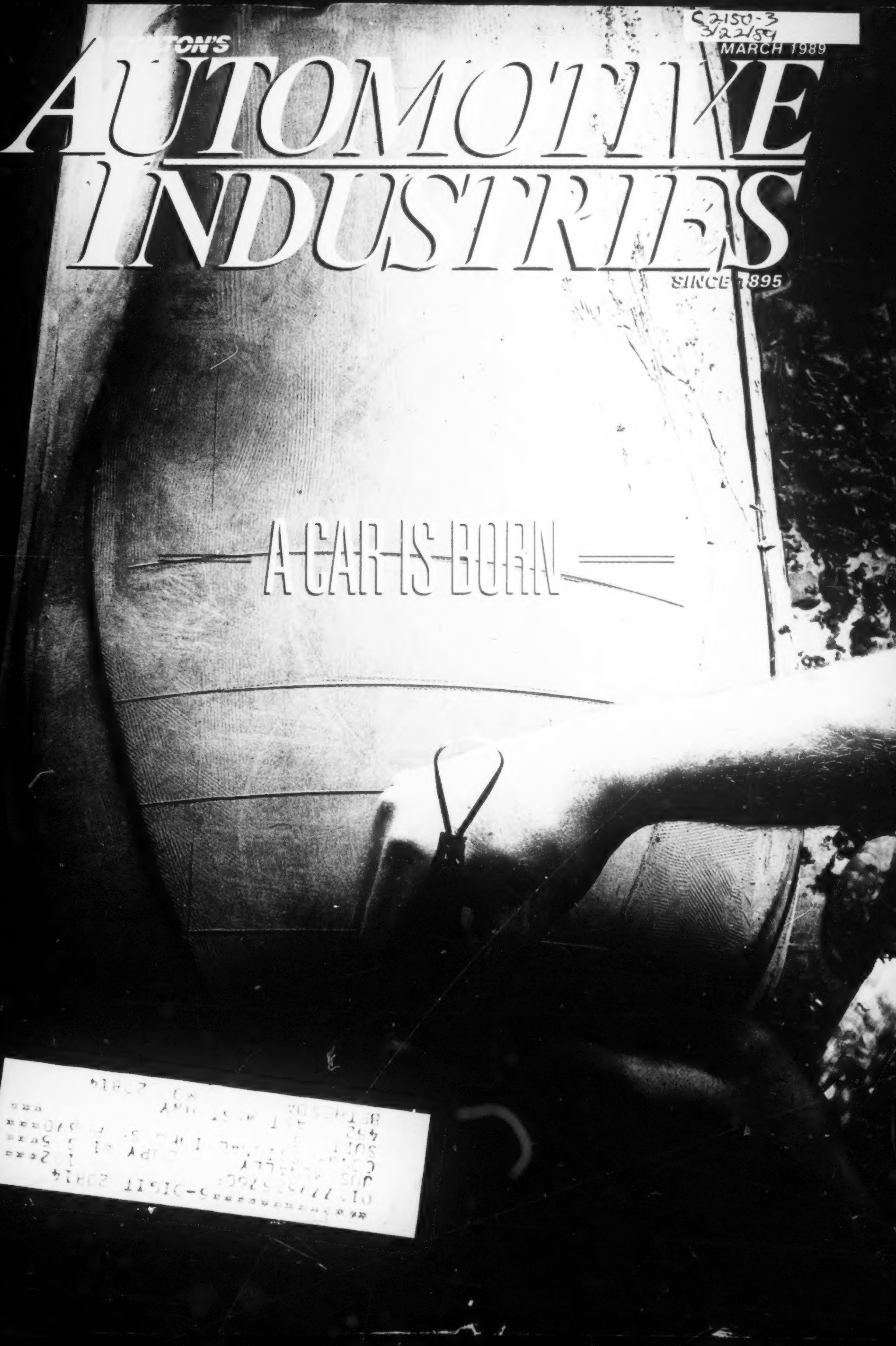

A CAR IS BORN

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MARCH 1989 VOLUME 169, No.3

CHILTON'S
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Cover: Our three-part series "A Car Is Born" examines the total process of automaking. Part I, Design, begins on p.34.
Cover photo: Jay Asquini/
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Special thanks to CCS.

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Axxess: Bold As Nissan

Nissan says its **new Axxess minivan** was styled to emulate Japan's famous *Shinkansen* bullet train. Indeed, the Axxess' A-pillars are raked 27.5° and the broad windshield spreads 36 in. (*910 mm*) from scuttle to header. Flush-fitting glass is used throughout, which works to conceal the vehicle's D-pillars while giving the five- or seven-passenger Axxess a .36 Cd. A sliding door gives access to the Axxess (Prairie in Europe) on either side. Power comes from Nissan's 2.4 L, 138 hp sohc four. A full-time four-wheel-drive version will also be offered, featuring three viscous couplings. Nissan hopes to sell about 18,000 Axxesses in the US in 1989.

Shop Around

Filling a 20-gal gas tank could cost you anywhere from $2.80 to $83.20 – depending on where you shop. And just so you don't get caught by surprise, Runzheimer International has compiled the following information indicating **worldwide gasoline pump prices,** based on full-service regular gas. Prices are based on December 1988 figures.

MOST EXPENSIVE	
Location	**Per Gallon**
Abidjan, Ivory Coast	$4.16
Tokyo, Japan	$4.10
Milan, Italy	$3.80
Naha, Okinawa	$3.77
Copenhagen	$3.75

LEAST EXPENSIVE	
Location	**Per Gallon**
Caracas, Venezuela	$.14
Lagos, Nigeria	$.30
Quito, Ecuador	$.37
Santo Domingo	$.53
Kuwait	$.54

Advertisement

Small Company's New Golf Ball Flies Too Far; Could Obsolete Many Golf Courses

Pro Hits 400-Yard Tee Shots During Test Round

Want To Shoot An Eagle or Two?

By Mike Henson

MERIDEN, CT — A small golf company in Connecticut has created a new, super ball that flies like a U-2, putts with the steady roll of a cue ball and bites the green on approach shots like a dropped cat. But don't look for it on weekend TV. Long-hitting pros could make a joke out of some of golf's finest courses with it. One pro who tested the ball drove it *400 yards,* reaching the green on all but the longest par-fours. Scientific tests by an independent lab using a hitting machine prove the ball out-distances all major brands dramatically.

The ball's extraordinary distance comes partly from a revolutionary new dimple design that keeps the ball aloft longer. But there's also a secret change in the core that makes it rise faster off the clubhead. Another change reduces air drag. The result is a ball that gains altitude quickly, then sails like a glider. None of the changes is noticeable in the ball itself.

Despite this extraordinary performance the company has a problem. A spokesman put it this way: "In golf you need endorsements and TV publicity. This is what gets you in the pro shops and stores where 95% of all golf products are sold. Unless the pros use your ball on TV, you're virtually locked out of these outlets. TV advertising is too expensive to buy on your own, at least for us.

"Now, you've seen how far this ball can fly. Can you imagine a pro using it on TV and eagle-ing par-fours? It would turn the course into a par-three, and real men don't play par-three's. This new fly-power forces us to sell it without relying on pros or pro-shops. One way is to sell it direct from our plant. That way we can keep the name printed on the ball a secret that only a buyer would know. There's more to golf than tournaments, you know."

The company guarantees a golfer a prompt refund if the new ball doesn't cut five to ten strokes off his or her average score. Simply return the balls — new or used — to the address below. "No one else would dare do that," boasted the company's director.

If you would like an eagle or two, here's your best chance yet. Write your name and address and "Code Name S" (the ball's R&D name) on a piece of paper and send it along with a check (or your credit card number and expiration date) to National Golf Center (Dept. H-1022), 500 S. Broad St., Meriden, CT 06450. Or phone 203-238-2712, 8-8 Eastern time. No P.O. boxes, all shipments are UPS. One dozen "S" balls cost $21.95 (plus $2.50 shipping & handling), two to five dozen are only $19.50 each, six dozen are only $99.00. You save $47.70 ordering six. Shipping is free on two or more dozen. Specify white or Hi-Vision yellow.

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1989

INDUSTRY REPORT CARD

APRIL 1989 VOLUME 169, No.4

CHILTON'S
AUTOMOTIVE INDUSTRIES
SINCE 1895

1989
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1989 INDUSTRY REPORT CARD

The second best year in history!

by JOHN McELROY

Who would have believed it? After all the hue and cry about the stock market crash in October 1987; after dire predictions of rising interest rates; and after many analysts were sure the expected downturn was finally at hand, 1988 turned out to be the second best automotive sales year in history. When all the dust had settled, the US market grew by nearly 4% in 1988, to 15.7 million units.

For the domestic automakers, it was a very good year. Combined profits of the Big Three totaled $11.2 billion, up from $9.4 billion in 1987. And GM, Ford and Chrysler all posted gains in market share—the ultimate measure of customer acceptance.

The imports, however, didn't fare as well. Every single European car company saw its US sales fall from the year before. And for the second year in a row, the Japanese were unable to sell all the cars they are allowed to bring in under the Voluntary Restraint Agreement (VRA).

Yet, the whole issue of what is an import and what is a domestic product continues to blur. Transplant production grew to 616,000 units in 1988 – a 13.3% increase over 1987. And this increase occurred even though VW closed its Westmoreland plant in July.

The drop-off in imports was even more pronounced with imported trucks which fell 20%. Not only are imported trucks saddled with a 25% import tax, but GM, Ford and Chrysler are fielding ever stronger products in this growing market segment. For the Big Three, being able to take truck share away from the imports is a major strategic goal. Why? Ten years ago, one out of four vehicles sold in the US was a truck. Today, the figure is one out of three.

No doubt about it, GM, Ford and Chrysler fared very well in '88. But to get a true picture, each one must be analyzed individually. So to put their performance in perspective, *AI* presents the 1989 Industry Report Card.

1989
INDUSTRY
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Ford could surpass GM as the world's largest automaker sometime in the 1990s.

Under our system, each American automaker is graded according to how it performed in six different categories. Each grade is given based on trendlines that indicate whether or not the company is improving in those categories. We don't compare one company to another. We compare each company against its past efforts, and then sum it up with an overall grade.

When the 1988 results came in Ford earned greater profits than GM for the third year in a row. And now it is starting to breathe down GM's neck when it comes to claiming which company is Number One in the world.

If measured in total dollar sales, Ford is 75% the size of GM – in vehicle sales it is 80% the size of GM. Five years ago, those figures were 60% and 64%, respectively. As we noted last year, Ford could conceivably surpass GM and become the world's largest automaker sometime in the 1990s.

QUALITY: Ford scored an important improvement in Quality, which is based on J.D. Power's Customer Satisfaction Index (CSI). But the latest CSI is based on data from 1987 models, a year in which Ford did not introduce any all-new cars, only facelifts. So we'll have to see if the company is able to maintain its current rating when the Continental, Probe and new T-Bird/Cougar are factored in during the coming years.

PROFIT PER UNIT: In 1988, Ford's profit-per-unit slipped slightly. Even though the company pulled in record profits from its overseas operations, it was somewhat dragged down by higher marketing costs – meaning dealer incentives – in the US. In addition, Ford is starting to spend big bucks on much-needed new powertrains. Nonetheless its performance is still spectacular.

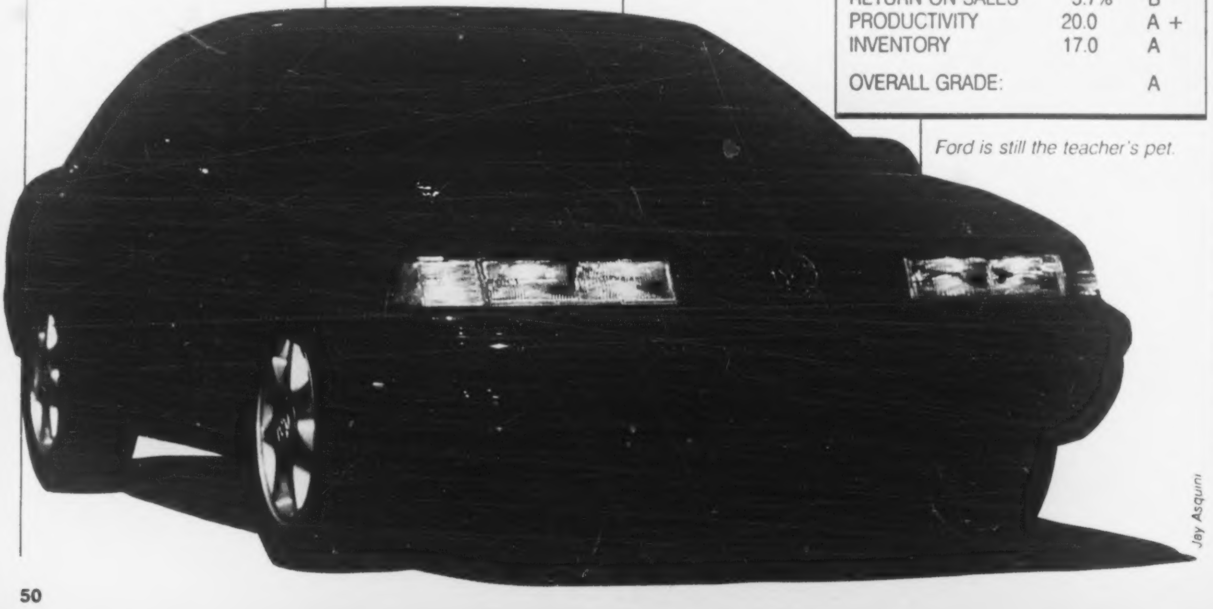
MARKET SHARE: With the intense competition in the US market, any company that can hold its own can be considered to be doing well. Yet Ford continues to take share out of the hide of its competitors. The US car market rose 3.9% in 1988, but Ford's sales rose nearly 9%. It picked up one full percentage point of market share.

RETURN ON SALES: This category provides a measure of how much money a company is able to keep compared to the total amount of money it took in. And this is one of the few areas where the Ford Motor Company didn't keep up with last year's performance. A drop in earnings from the com-

FORD: STILL BEST IN CLASS

CATEGORY	SCORE	GRADE
QUALITY	106.0	B +
PROFIT/UNIT	$1014.0	A
MARKET SHARE	24.1%	A +
RETURN ON SALES	5.7%	B
PRODUCTIVITY	20.0	A +
INVENTORY	17.0	A
OVERALL GRADE:		A

Ford is still the teacher's pet.



Jay Asquini

pany's financial services contributed to the decline here. But even when you break out the automotive operations from the total corporate picture, the company still slipped from year-ago levels. Nevertheless, Ford is still best in class here.

PRODUCTIVITY: Once again, Ford showed that every year it needs fewer people to build more vehicles. And that efficiency translated into $2700 profit sharing checks for the average UAW employee working for Ford. For 1988, productivity was up nearly 7%, and though that wasn't as good as it achieved last year, it still rates as world class.

INVENTORY TURNS: Ford cranked out another solid improvement in how it ran its manufacturing operations. Inventory turns are a good measure of how well a company can match planning to production. Instead of building up huge banks of in-process goods, Ford was increasingly able to use exactly what it produced. And by eliminating inventory, it undoubtedly reduced repair work and scrap. And that in turn has a very positive effect on reducing costs at the same time it increases quality.

Chrysler's management has a well-earned reputation for not wasting time. When it comes to making decisions, they seem to get things done fast.

And while many industry observers expected Chrysler to take several years to fully integrate AMC's operations, it looks like the job might already be done.

QUALITY: Chrysler's strong showing in this category is nothing short of spectacular. It has pulled even with Ford, and as *AI* speculated two years ago. Its rate of improvement may push it right beyond Ford (*see "Will Chrysler's Quality Knock Ford Off Its Pedestal?" Jan. '87 AI*). One thing that should be pointed out, however: J.D. Power's CSI rating also factors in dealer service. When it comes to measuring quality as the vehicle leaves the factory, Ford is still ahead. Nonetheless, Chrysler is closing in very, very fast.

Chrysler: Making money on trucks

CHRYSLER: AMC DIGESTED

CATEGORY	SCORE	GRADE
QUALITY	106.0	A +
PROFIT/UNIT	$243.0	D
MARKET SHARE	13.5%	A
RETURN ON SALES	2.9%	D
PRODUCTIVITY	18.0	B -
INVENTORY	22.9	B
OVERALL GRADE:		B -

PROFIT PER UNIT: For the first time in its history, Chrysler sold one million cars and one million trucks in the same calendar year. Yet in 1988, that didn't help the bottom line much. The company's profit per unit fell 50%. A big drag on profits was Chrysler's high incentive costs—rebates and low interest loans. The need for these sales incentives was especially critical on Chrysler's cars. The company's trucks, minivans and Jeeps do a much better job of selling themselves.

US MARKET SHARE: Chrysler's management has shown that it is unswervingly focused on the long-term view. By leaning heavily on aggressive pricing, the company has been able to increase its market share. That hurt the bottom line, but it sure moved a lot of product.

In our opinion, it is far better that Chrysler should sacrifice some short-term profits, rather than let its competitors steal its customers away. Indeed, this kind of competitive management thinking will probably prove far more effective to the long-term health of the company than trying to push for tariffs and quotas to keep the imports at bay.

RETURN ON SALES: Chrysler's sales rose by $6.2 billion last year, to $35.4 billion. Yet, its profits fell by nearly $240 million. Since its non-automotive operations (Chrysler Financial Corporation and Chrysler Technologies) produced record earnings, it's obvious that Chrysler's automotive operations were a big drag on profits. Indeed, non-automotive operations accounted for nearly 40% of the corporation's profits, even though they accounted for only 13.6% of sales!

PRODUCTIVITY: Chrysler achieved a 10% improvement in its worldwide productivity in 1988. And while *AI* commends the company for this, we still had to grade it rather harshly. Why? Because Chrysler still hasn't caught up to the level of productivity it achieved before it bought AMC.

But therein lies the catch. By the end of 1988, the ex-AMC manufacturing operations still hadn't been brought up to Chrysler's level of productivity. Yet, if Chrysler maintains its present rate of improvement, that will not be the case this time next year.

INVENTORY TURNS: Although Chrysler wasn't able to pull its productivity numbers up to their pre-AMC levels, it sure was able to do so in this category. In fact, to achieve such a big improvement Chrysler's manufacturing people must be commended for the amount of in-process inventory they took out of the ex-AMC plants.

Like a locomotive leaving the station, General Motors is slowly but surely gathering steam. The driving wheels on the engine are slipping as it strains to pull all of the train cars down the track. And though there's an awful lot of weight to try and get moving, all the wheels are indeed starting to roll.

1989 INDUSTRY

REPORT CARD

GM managed to stop its 10-year-long slide in market share.

QUALITY: Zounds! According to the CSI rating, GM has blown right past Ford. In fact, the 1988 Power CSI rating puts Cadillac ahead of Toyota!

As we noted earlier, the CSI factors in dealer service. That's how Cadillac nipped Toyota. Yet when you look at the quality of cars as they come out of the factory (based on Power's Initial Quality Survey), it's amazing to see that the B-O-C group has rocketed up the chart, displacing Honda, Mazda and Lincoln along the way. This kind of quality is certain to improve GM's share of market.

PROFIT PER UNIT: Whereas Ford and Chrysler slipped in this category, GM banged out a big improvement. And it was GM's overseas operations that contributed the yeoman's share, providing $2.7 billion in profits, up from $1.9 billion in 1987.

Even so, GM's North American operations improved their operating capacity by closing assembly plants in Norwood, OH and Pontiac, MI. The company sold a record amount of very profitable trucks. And GM's big-profit car lines—Cadillac and Buick—picked up their sales somewhat.

US MARKET SHARE: GM's performance in this category is something of a mixed bag. True, the company did manage to put a stop to its 10-year-long slide in market share. But it did this solely on truck sales—its car lines continued to lose share. Ominously, the GM10 cars failed to produce the sales gain the corporation was looking for.

Yet, if there's a silver lining in this, one has to remember that the Corsica and Beretta got off to a slow start, but now they're selling very strongly. If the four-door GM10s are able to pull off a similar resurgence, GM car share could pick up in 1989.

RETURN ON SALES: GM's bottom line is looking better all the time. Last year profits increased nearly 37%. That figure looks all the more impressive when you consider that GM paid no income taxes in 1987, yet paid nearly $1.5 billion in 1988. And it also put more money to the bottom line even though it had to absorb high marketing costs in the US market.

Of course, one major reason GM was able to improve its bottom line was by slashing capital spending by $1.6 billion from 1987 levels.

PRODUCTIVITY: In 1987 GM needed 673,000 employees worldwide to make 7,765,000 vehicles. In 1988, it only needed 624,000 employees to build 8,108,000 vehicles. That's how the company was able to boost its productivity.

Though GM is well behind Ford and Chrysler in this category, you have to remember that GM builds many more components in-house than the others do. In any case, we're not giving grades based on how GM fared compared to its domestic competitors—we're grading it on how it did compared to its own past efforts.

INVENTORY TURNS: If there is one area where GM has consistently improved, it's in this category. Inventory turns are an important measure of how well a company is managing its manufacturing operations, and though the progress may be slow, it is certainly steady. And as GM imbues its Synchronous Manufacturing system (*see "GM's Plant Saver, March '89 AI*) throughout its operations, and as it adopts more quick die change and quick tool change procedures, this number should become better still. AI

GM: GATHERING STEAM

CATEGORY	SCORE	GRADE
QUALITY	107.0	A
PROFIT/UNIT	$599.0	B +
MARKET SHARE	35.2%	C
RETURN ON SALES	4.4%	B -
PRODUCTIVITY	12.5	C +
INVENTORY	18.8	B
OVERALL GRADE:		B

GM: Record profits from overseas.

WORLDWIDE PRODUCTIVITY COMPARISON

Who gets the most out of their operations?

by JOHN McELROY

An *AI* survey of 1988 automotive production and employment shows that Japanese automakers still enjoy a huge productivity lead over their US and European competitors.

Despite strong strides in productivity improvements that have taken place in the US in the last five years, the least productive Japanese automaker (Fuji) is still 90% more efficient than the best American maker (Ford). And Fuji is three times more efficient than the best European maker (Peugeot).

Ford and Peugeot can be consoled because their productivity is up sharply, while that of Fuji, Nissan and Mazda are slipping. And both of them are even chipping away at Toyota's lead. Even so, it must be distressing to see that Toyota is so far ahead, and still improving.

This productivity comparison measures how many salary and hourly employees were needed to build the number of vehicles (cars, trucks, buses and tractors) produced in a given year. It also includes the employees involved in automotive parts producing operations.

But it excludes employees not involved in automotive production, such as those who work at Ford Aerospace, GMAC, or Fiat Aviazone. Nor does it include vehicles that may have been sold by one company, but built by another. The Ford Festiva (made by Kia), the Chevrolet Sprint (made by Suzuki) and Dodge Colt (made by Mitsubishi) are examples of these kinds of vehicles.

These productivity figures are not adjusted for the level of in-house parts production. However, it's unlikely that this would affect the rankings in this survey. For example, Chrysler makes 30% of its components in-house, which is the same as the Japanese automakers. So Chrysler's productivity is a very good apples-to-apples comparison with those of the Japanese.

And even if Ford's productivity figures were re-adjusted to represent a 30% level of in-house parts production, it would not move the giant automaker's ranking by even one position—although it would improve its 1988 output to 24 cars per employee.

Clearly, these productivity figures show that the competitive battleground is still sharply defined by geographic region.

PRODUCTIVITY RANKING BY AUTOMAKER

COMPANY	AUTOMOTIVE EMPLOYMENT	VEHICLE PRODUCTION	1988 VEHICLES/ EMPLOYEE	1985	1983
1. Suzuki	12,000	845,923	70.4	---	72.8
2. Toyota	65,000	3,968,697	61.0	57.3	58.0
3. Daihatsu	11,300	643,485	57.0	---	---
4. Honda	33,250	1,868,716	56.2	40.3	43.0
5. Mitsubishi	25,000	1,261,409	50.4	47.6	---
6. Mazda	29,089	1,220,664	42.0	47.0	43.4
7. Isuzu	13,800	575,978	41.7	---	---
8. Nissan	54,800	2,164,218	39.5	41.8	44.0
9. Fuji (Subaru)	15,372	595,286	38.7	40.7	46.5
10. Ford	318,175	6,375,558	20.0	16.9	14.3
11. Chrysler	131,438	2,361,250	18.0	17.0	16.4
12. Peugeot	158,100	2,102,500	13.3	10.5	---
13. General Motors	624,000	7,830,660	12.5	12.7	11.7
14. Volkswagen	253,000	2,849,600	11.2	9.2	---
15. Fiat	234,000	2,374,800	10.1	10.3	---
16. Volvo	75,340	470,220	6.2	7.0	---
17. Daimler-Benz	338,400	742,025	1.9	---	---

T&OHI DRIVELINE

Rockwell Marketing Cat Trannies

Rockwell has started selling Caterpillar-manufactured powershift transmissions for off-highway applications to OE manufacturers in Europe and North America. Nine models, **from 70 to 2000 hp ratings**, are being sold, all with a one-year, unlimited hours warranty. Don DeFosset, president of off-highway and driveline operations, says the new transmissions broaden Rockwell's product lineup and add another "critically important" drivetrain element. Still to come, and substantially more important, are on-highway truck transmissions from Rockwell.

The Good News Keeps On Truckin'

Last year proved an **even better year for trucks** in the US than the optimists hoped for. Most notable were the substantial gains in classes 4 and 8. Changes in the federal tax laws made the class 4 market more attractive, and drew in foreign competition like Iveco and several Japanese makers. In the big class 8 category, unexpected market strength continues in virtually every vocational and application grouping. Source: Motor Vehicle Manufacturer's Assocation.

US TRUCK SALES BY WEIGHT CLASS

Class	1988	1987	% change
Class 1 (to 6000 lb GVW)	2,926,028	2,696,127	+ 8.5
Class 2 (6001-10,000)	1,333,101	1,175,080	+ 13.4
Class 3 (10,001-14,000)	14,252	14,007	+ 1.7
Class 4 (14,001-16,000)	21,181	2,129	+ 894.9
Class 5 (16,001-19,500)	8,310	8,185	+ 1.5
Class 6 (19,501-26,000)	53,603	44,282	+ 21.0
Class 7 (26,001-33,000)	102,818	102,583	+ 0.2
Class 8 (33,001 and over)	147,749	131,156	+ 12.7
TOTAL	4,607,042	4,173,549	+ 10.4

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MAY 1989 VOLUME 169, No.5

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Cover art by Randy Hamblin

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AUTOMAKING

We go back in the USSR to see how a massive modernization program is transforming the Soviet automotive industry.

by PAUL LIENERT

The spanking new Moskvich Aleko whisked us through a yard littered with half-opened crates of new machinery, many labeled with such familiar names as Ex-Cell-O and Liebherr. In mid-February, snow covered most of the unprotected equipment awaiting installation in the refurbished Moskvich factory, while some older, abandoned pieces lay rusting in the adjacent yard.

Suddenly, a red fire truck raced past with lights flashing, and tore through a side entrance of the plant. Our driver seemed unconcerned as we continued our tour—through a back door, up a serpentine ramp to the second story of the aging, dimly lit main assembly building.

Later, we encountered the fire truck again, this time parked on the first floor near a smoldering paint machine. Plant manager Valery Sokolov jumped from the car and walked over to talk to one of the asbestos-suited firefighters. Then he climbed back inside with us, and with a shrug, continued his description of the plant.

LENIN KOMSOMOL AUTOMOBILE PLANT (AZLK)

A visit to the Lenin Komsomol Automobile Plant in Moscow is a study in paradox: One of the Soviet Union's oldest auto factories, it will soon be one of the industry's most modern facilities when an unprecedented billion-ruble renovation is completed in the early 1990s.

"When we have the new machinery in place, there will be only one plant in the world as modern as ours," boasts Sokolov, deputy general director and production boss at Automobilny Zavod imeni Leninsky Komsomola (AZLK). "That will be the General Motors Saturn plant."

Asked for his source of knowledge on Saturn's production methods, which have been one of the US industry's best-kept secrets, the slender, gray-haired Sokolov replies with a trace of a grin: "I can't tell you. That's classified."

Modernization of the main assembly plant and construction of a new engine plant, most of it funded by the state, has been a major undertaking for AZLK. The expense of retooling is enormous, compared with the sums spent by the Volga Auto Works, which produces nearly five times as many cars. Machinery is still being ordered from Western European and Japanese suppliers; the plant, when completed, will have a dazzling array of more than 500 robots, according to Sokolov, with a level of automation previously unheard of in the Soviet automotive industry. Total investment is expected to approach $1.5 billion.

"Our home market does not require this level of automation," Sokolov observes. "But if we are to export, we need to build cars with world-class quality."

With the Soviet auto industry in the midst of a massive modernization drive, the five principal automakers last year built only 1.1 million cars, well below their average annual output since 1980 of 1.3 million. The tally was about equal to Chrysler Corp.'s 1988 auto production and only a fraction of the seven million cars assembled last year in the US.

The Soviets would like to export more cars, too, to gain hard currency to help finance their expansion, but the domestic appetite for automobiles appears to be insatiable. According to the best estimates, there are a mere 50 cars on the road for every 1000 citizens in this country of 280 million. At the current rate of production, the Soviets should catch up to the US average of one car for every two persons by the year 2100.

Until it can satisfy local demand, the Soviet industry isn't likely to launch a major export push in the West. Although prospective distributors, including New York-based SATRA Corp. and Oregon megadealer Ron Tonkin, are already lining up to secure US distribution rights, it may be 1995 before Russian-built cars appear on American streets in any significant numbers. And when they finally arrive, it's a good bet the first model off the boat will be a Lada.

VOLGA AUTO WORKS (VAZ)

If the Moskvich plant appears to Western eyes to combine elements of the old Dodge Main complex and the

FROM "THE GM OF THE USSR" TO THE REAL THING

Dr. Moisey B. Shkolnikov is a senior structural engineer with B-O-C in Troy, MI. He was formerly with NAMI, the Soviet Union's major automotive research institution. We asked him to comment on his experiences in both auto industries.

Dr. Moisey B. Shkolnikov

"It was a pleasure to learn from Paul Leinert's article of the progress being made at VAZ both in production and welfare of employees. Extremely high by the USSR standards, monthly income up to 1200 rubles and company cars for middle managers are nice achievements. It is really difficult for me to compare the USSR working environment of the early '80s with GM's in the late '80s, as I left the USSR in 1981. All automotive companies, including VAZ, were subsidiaries of the Ministry of Automotive Industry.

"There was no competition between the companies. Job security was guaranteed. The lack of computers and software available slowed down the advancement of engineering technology and design. Nevertheless, many automotive institutions, including NAMI, were conducting a lot of R&D. It might be that the situation has improved since then."

TOURING VAZ: A WHOLE LADA CARS

Nestled at the foot of the scenic Zhiguli Hills, Togliatti is the home of the massive Volga Auto Works, the country's newest – and by far the largest – automaker.

The factory complex was built in the late 1960s with the aid of Italian auto giant Fiat, while the city itself was named in honor of the founder of the Italian Communist Party. Ground was broken for the plant in January 1967; the first car, a Fiat 124 derivative, rolled off the line in April 1970.

VAZ (Volzhsky Avtomobilny Zavod) now produces several different models, including updated versions of the original Fiat designs, which are sold under the Lada and Zhiguli brand names. The factory also makes the Niva compact utility vehicle, and two years ago introduced a new front-drive series called Samara. Last year, it began pilot production of the new Oka minicar.

Although the Samara is only two years old, the factory already is working on a replacement for the early 1990s, including a high-performance 16-valve version, and a full range of body styles. VAZ also is discussing local production of automatic transmissions, and other components for the new range, with GM.

"We believe this model will take us to the 21st century," says Dr. George Mirzoev, VAZ chief design engineer.

Once every three minutes, a new car rolls out the door. Some 2600 vehicles are completed each day and shipped to destinations around the globe. In 20 years, the factory has assembled over 12 million cars.

VAZ still relies heavily on manual labor in much of its operations. Throughout the plants, pockets of workers, many in their mid to late 20s, gather informally to chat over tea break; in the middle of one dimly lit assembly area, two workmen enjoy a hotly contested game of ping-pong on a battered table. Signs of Western pop culture are evident; a row of machinery in one plant bears hand-lettered names of rock groups Led Zeppelin and Whitesnake.

Hourly employees at VAZ typically work a nine-hour shift five days a week, with a daily 48-minute lunch break. They earn an average of 250 roubles a month (about $2.50 an hour, or $5000 a year) in salary and bonus. Skilled trades are paid slightly more, while senior officials can earn up to 1200 roubles a month (about $24,000 a year), including incentives and bonuses. Middle and top managers get a company car; top executives get a driver. Employee benefits are numerous. – *PL*

VAZ's Lada Samara (left), launched in '87, and new AZLK Aleko, both front-drivers.

1988 AUTOMOBILE PRODUCTION IN THE USSR
by automaker

VAZ	AZLK	GAZ	ZAZ	IZH	TOTAL
720,000	120,000	75,000	150,000	50,000	**1,115,000**

Source: Avtoexport.

TOURING AZLK: FROM MODEL A TO ALEKO

The Lenin Komsomol Automobile Plant in Moscow (Avtomobilny Zavod imeni Leninsky Komsomola, or AZLK) has evolved over the past 60 years into one of the USSR's most modern auto plants.

Established with financial and technical assistance from Henry Ford in 1930 as the Young Communist International Auto Plant (KIM), the factory assembled a version of Ford's Model A using mostly American-built parts, as well as Ford-based trucks through the 1930s. Reorganized in 1939 as the Moscow Light Automobile Works (MZMA), the plant produced its first original design, called KIM-10, in 1940 before being converted to a military vehicle repair facility during World War II. In 1947, the factory introduced a new Opel-based sedan with the Moskvich brand name; exports to Western Europe began in 1949.

The plant was overhauled in 1968 and renamed AZLK to mark the 50th anniversary of the Lenin Komsomol (Young Communist League).

When the current modernization of the plant, which has converted to assembly of the new Aleko compact, is completed, the complex will house more than 7.5 million ft^2 of production and technical facilities on 700 acres, including a design and engineering center and a small test track.

The Aleko, which was developed in conjunction with Renault, eventually will spawn a family of vehicles, including a small van and a pickup. AZLK will produce about 120,000 vehicles this year and 160,000 in 1990, and anticipates annual production at the home plant and satellite locations will reach 300,000 by the year 2000. The factory also has signed cooperative agreements with plants in Bulgaria and Czechoslovakia to assemble future versions of Aleko, and expects to begin exports this spring to Western Europe for the first time in nearly 20 years.

"This won't be a big step forward in the world market," concedes Sokolov, "but it will help improve our image in the West. It is not our strategy to conquer the world."

The Moscow plant employs about 25,000, half of whom are women. Posters placed strategically throughout the plant exhort workers to maintain high levels of quality, praise outstanding employees, honor past officials and even warn against possible AIDS contamination in Red Cross blood donations. Most workers greet visitors with a studied air of nonchalance.

A 40-hour work week is the norm, with the typical production worker earning about 240 roubles a month (about $4700 a year) in salary and bonus. Workers are provided with extensive subsidized health care, child care, housing and cultural/sports facilities.— [illegible]

new GM Poletown facility, the sprawling Lada complex in Togliatti, about 600 miles southeast of Moscow, may be Russia's answer to the Ford Rouge complex.

Here, the Volga Auto Works operates the world's largest auto plant, producing nearly 90% of its own components on-site. It is not without a trace of envy that officials at other Soviet automakers often refer to the company as "the General Motors of the Soviet Union."

As the country's leading vehicle manufacturer, Volzhsky Avtomobilny Zavod (better known by its acronym VAZ) builds more than half the cars produced each year in the USSR. About 720,000 units a year roll off its three assembly lines, and 45% are exported to sister Comecon countries and the West. VAZ employs 95,000 workers in its automaking operations and another 25,000 in affiliated industrial enterprises.

Everything here is done on a grand scale. The main VAZ complex encompasses nearly 2½ square miles, with production facilities totaling 22.5 million ft^2. Operations include a foundry, stamping plant, engine and transmission assembly plant, body assembly plant, machine tool and die shop, administration building and a new $800-million technical center that will house R&D, engineering, design and a pilot assembly line.

Much of the original machinery, including the huge 20-year-old Innocenti presses, is still in use, although VAZ is gradually replacing worn-out equipment with more modern machines, many of Japanese design. An affiliate, called AutoVAZ, is even building its own presses and robots under license from Western firms, supplying them to other Soviet automakers.

By Western standards, the plant is barely automated; only 80 robots are employed, mostly for welding and subassembly, although painting operations are expected to be automated in the near future.

VAZ is also a principal figure in the Soviet government's ambitious program to double domestic auto production during the next decade. VAZ has teamed up with the country's largest truckmaker, KamAZ, to create the first in a series of low-priced "people's cars" which the Soviets hope to mass-produce in the 1990s at a new complex in Yelabuga, on the Kama River just east of the Ural Mountains. The tiny Oka hatchback, which sells for 3500 rubles ($5775), is being produced in limited quantities at both plants while the Yelabuga plant, once earmarked for tractor production, is being constructed and equipped.

"Our intention [with the Oka] is to meet the demand for young, low-income families," says Dr. George Mirzoev, chief design engineer at VAZ, which developed the car. VAZ will supply components and machinery for the Yelabuga plant, which will be built in stages. Ultimately, the Soviets hope to produce up to a million cars a year at the facility, including larger, more powerful derivatives of the Oka.

In addition to its own projects, VAZ is supplying components and some technical assistance to the Zaporozhye Auto Works (ZAZ) near the Black Sea for its new front-wheel-drive Tavria hatchback. The ZAZ plant continues to produce a tiny rear-engine model, similar to the German NSU, called Zaporozhets, but expects to convert production completely to the newer Tavria model by 1990. Annual output is about 150,000 units – nearly all of it for Soviet consumption – although Tavria exports will begin later in '89.

GORKY AUTO WORKS (GAZ)

The Gorky Auto Works (GAZ) has made headlines in the West for its negotiations – subsequently unsuccessful – with Ford Motor Co. GAZ had hoped to replace its aging Volga sedan, used widely by Soviet taxi fleets, with a version of the European Ford Scorpio. One hitch was whether Ford would permit the Gorky plant to export cars to the West in exchange for hard currency, which it sorely needs to pay for renovation and modernization of tools and equipment.

Gorky's ties with the US automaker date to the early 1930s, when Henry Ford helped construct the factory and supplied parts and the design for the Model A, the first mass-produced automobile in the Soviet Union. (The Gorky plant was designed by Detroit architect Albert Kahn.)

The plant continues to produce the Volga, whose basic design dates to the 1950s, and limited numbers of the big Chaika sedan, which it hopes to update in 1990. Production meanwhile has fallen from a peak of 150,000 in the early 1980s to around 75,000 last year. GAZ is also a major supplier of medium trucks, building more than 300,000 in 1988.

There are several factors which have prevented the Soviet automotive industry from evolving into a global powerhouse to rival the US or Japan, including a cohesive central plan for the industry and lack of domestic or foreign competition within the state-controlled economy.

"The history of the Soviet auto industry is such that each plant developed separately," notes Alexandr Zvegintzev, deputy director of Autoexport, the Moscow-based foreign trading firm which has served since the mid-1950s as the link between the Soviet industry and the West.

"A distinguishing feature of Soviet automakers is that each plant produces most of its own components. In the absence of competition, the companies were not forced to look for ways to reduce costs, such as developing common components. Consequently, there are no big independent parts suppliers, such as Bosch and Lucas in Western Europe."

Previously, all automakers had to return their profits to the state, which in turn allocated funds for new tooling and development of new models. Under new regulations, the auto companies are now allowed to keep 40% of their profits to plow back into operations.

They are also being given a greater degree of autonomy; starting April 1, all vehicle manufacturers gained the right to negotiate their own export programs and ventures with foreign firms. **AI**

AUTOMOTIVE INDUSTRIES: TO RUSSIA, WITH LOVE

In 1972, the capitalist media barons of the Chilton Company granted Mashinostroenie Publishers, Moscow, USSR, the rights to publish a Russian language version of *Automotive Industries* in the Soviet Union. The relationship continues today.

The Russian *AI* is not exactly as slick as our original. It's devoid of color and advertising, and you can almost feel the wood pulp in the paper. Artwork is lifted right off of the original pages and screened, giving everything a 'Siberian winter' appearance.

When Paul Lienert showed some copies to people in the Soviet auto plants, there was much fascination. Obviously, Paul says, many had never seen the magazine, and were astonished that such a publication exists in their own language. Perhaps upper management types keep the *AI's* to themselves – after all (to paraphrase Orwell), all autoworkers are equal, but some are more equal than others.

At least our Russian editor gives his exploited American comrades our bylines. Set in Cyrillic type, Cathy Coffman is **К. Коффман**, Gerry Kobe is **Дж. Коуб** and I'm **Л. Брук**.
Go figure. – *Lindsay Brooke*

AUTOMOTIVE INDUSTRIES
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AUTOMAKER QUARTERLY REPORT

First quarter '89: Domestics slip while imports gain.

by Dr. THOMAS O'GRADY

Both the passenger car and light truck markets weakened during the first quarter of 1989, despite frequent extensions and additions to most incentive programs. The heaviest losses during the quarter came from "traditional" domestic cars, European models, and Korean imports. Yet transplants and Japanese imports increased their passenger car shares.

GM's total passenger car share dropped from 37.6% in the first quarter of 1988 to 35.4% in early 1989. Of the five GM divisions, only Pontiac and Cadillac managed to maintain or increase their market share so far this year. Chrysler's share of the passenger car market also fell during the first quarter, with sales suffering most in the small through mid-size segments. Chrysler now must fill in gaps in several markets.

Ford's total volume is also down for the quarter, but its market share did rise from 21.7% in early '88 to 23.3% in early '89. Both the Crown Victoria and Taurus/Sable weakened in their markets during the first quarter.

Dr. Thomas O'Grady heads Integrated Automotive Resources, Inc. in Wayne, PA.

Among foreign manufacturers, Honda, Nissan, Subaru and Toyota each gained market share during the first quarter. The expansion of North American Civic, Sentra and Corolla production since early 1988 has impacted market share the most.

The Ford Escort regained its position as the best-selling car in the US, after dropping to second place against the Honda Accord at the close of '88. The Honda Civic, both imported and US-built models, was the only first-time addition our Top Ten list. Several of 1988's best-selling import models dropped out of the first quarter list, including Toyota's Camry and Corolla models and the Hyundai Excel. Look for Camry and Corolla to return to the list later in the year as Toyota's domestic assembly facilities increase production. AI

WHAT'S HOT! Domestic Auto Sales 1st Quarter 1989

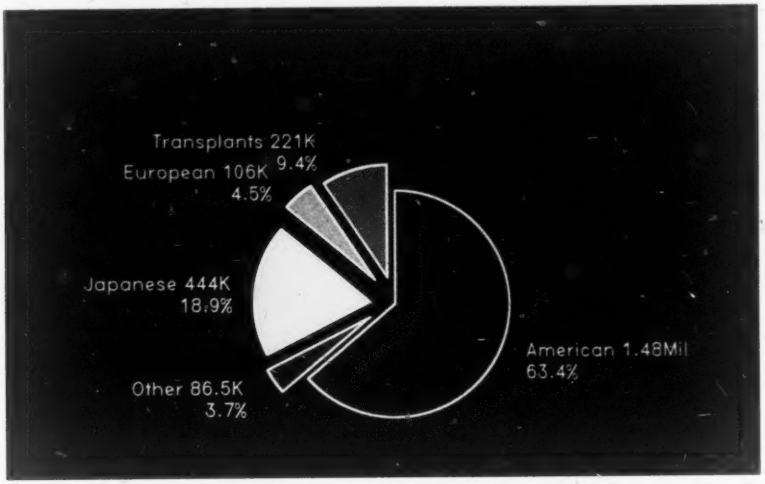
Carline	'89	'88	% Change
Escort	87,918	92,059	(4.50%)
Corsica/ Beretta	86,767	101,120	(14.19%)
Taurus	83,275	101,901	(18.28%)
Cavalier	72,862	71,347	2.12%
Accord*	72,254	78,061	(7.44%)
Sentra*	62,376	56,836	9.75%
Tempo	59,783	72,250	(17.26%)
Celebrity	57,136	71,288	(19.85%)
Civic*	50,880	42,360	20.11%
Ciera	48,757	59,451	(17.99%)

* – Includes imports
( ) – Negative value

US Passenger Car Market Shares, 1st Qtr. 1989

Manufacturer	Sales	% Total
General Motors	829,986	35.42%
Ford	546,068	23.31%
Chrysler	247,955	10.58%
Honda/Acura	163,512	6.98%
Toyota	143,081	6.11%
Nissan	125,402	5.35%
Mazda	54,120	2.31%
Hyundai	49,691	2.12%
Subaru	37,778	1.61%
VW/Audi	34,338	1.47%

(Continued p 78)



Passenger Car Market Share By Geographic Base

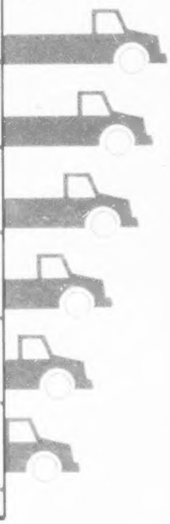
First Quarter 1989

Manufacturers	Total Sales	Total Market Share
American	1,483,790	63.33%
Japanese	444,771	18.98%
European	106,430	4.54%
Transplants	221,554	9.46%
Other Imports	86,578	3.69%
Total	**2,343,123**	**100.00%**

1ST QUARTER 1989 DOMESTIC LIGHT TRUCK PRODUCTION

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 1Q '89	TOTAL 1Q '88
FORD	184,880	94,531	64,133	61,493	24,021	35,956	465,014	451,557
CHEVROLET	153,765*	80,529	42,279	44,830	35,012	41,156	397,571	342,827
CHRYSLER	28,586	28,604	28,163	135,661	---	---	221,014	198,601
GMC	48,210*	20,855	15,052	11,034	11,337	11,329	117,817	119,856
JEEP	---	8,937	---	---	4,306	80,248	93,491	78,325
NISSAN	---	35,030	---	---	---	---	35,030	33,613

*Includes Suburban and P-model



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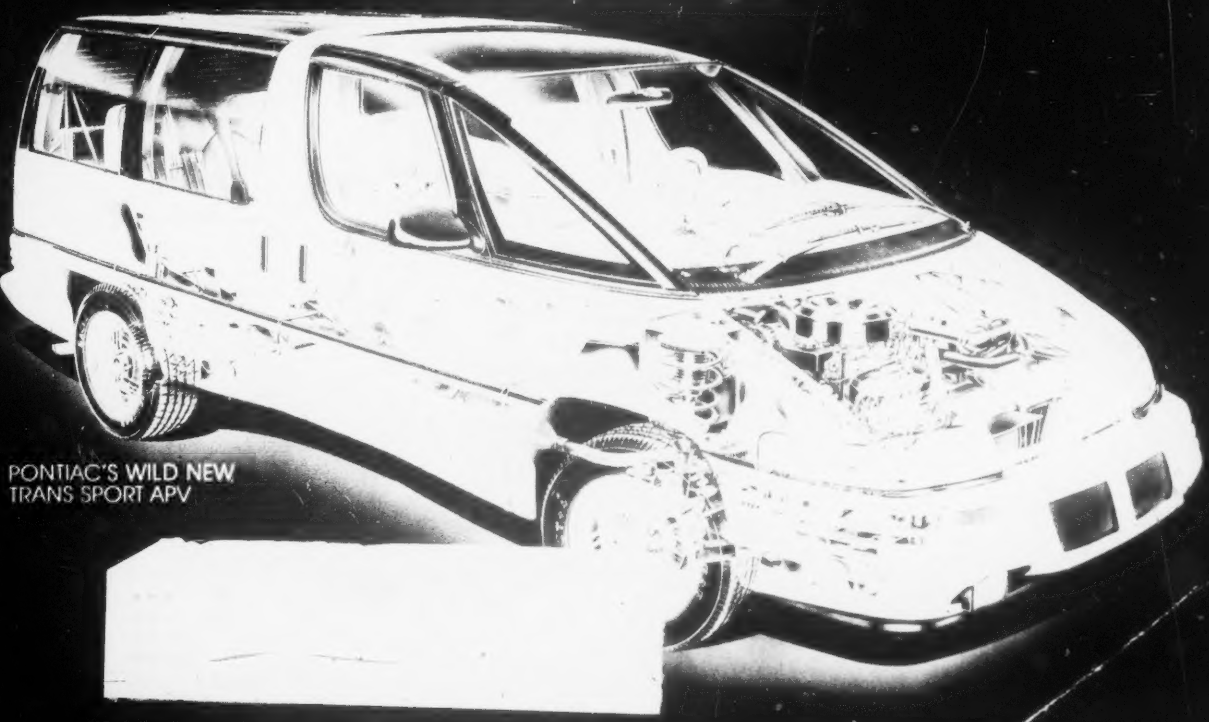

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COMPANY	AD BUDGET (million $)	COST PER VEHICLE
Toyota	$263	$281
Nissan	$166	$258
Mazda	$160	$458
Honda	$110	$171
Mitsubishi	$120	$774
Hyundai	$ 71	$268
Lexus	$ 70	$875
Isuzu	$ 68	$591
Subaru	$ 66	$423
Infiniti	$ 60	$800
Acura	$ 55	$429
TOTAL	$1.21 billion	

Source: Mitsubishi Motor Sales of America

Probing The Swiss Market

Mazda Motors Manufacturing USA manufacturing VP Jim Korowin says that in addition to the 5000 Japan-bound Ford Probes made at his Flat Rock, MI plant, they're also targeting the European market. "We're sending **1000 Probes to Switzerland** this year," he confides. Adds Korowin's boss, MMUC president Osamu Nobuto: "By the mid-90s Mazda will be buying engines from Ford as the primary MMUC (Flat Rock) engine."

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T&OHI JOURNAL

Ag Business Faces Undercapacity

by John Stark

A major turnaround looms in the North American farm machinery business, the likes of which could far exceed the boom days of 1979.

All of the industry's basic business fundamentals have already fallen into place.

Inventories are low. Availability of good, used farm tractors and self-propelled combines in stock at dealer outlets remain at low ebb. Used machinery prices are rising rapidly. Steep price discounting on new vehicles has almost disappeared, as profit margins continue to climb.

North American factories are buzzing with activity. John Deere and J.I. Case soon plan to bump daily output targets up again. Summer assembly shutdown periods may be cut to reflect a sharply higher level of business seen starting in the 1989 fourth quarter.

More and more officials in the US and Canadian farm machinery business are revising near-term economic outlooks to reflect a return to the cyclical periods of boom and bust during the 1960s and 1970s.

Manufacturers, in general, expect that retail sales of the vehicles will advance this year by about 7%. In 1990, explosion could occur. Farm machinery sales are seen soaring by 25% to 40%—a dramatic turnaround after eight straight unprecedented years of downturn.

During the 1980-1988 downturn, farm machinery producers pared assembly capacity to reduce overhead costs and remain liquid. Tractor-making capacity was cut by about 25%. Combine manufacturing capacity remained relatively unchanged, despite the corporate failure of Massey Combines Corp.

John Stark is editor and publisher of Stark's Off-Highway Ledger.

Some tractor makers are now privately concerned that insufficient local assembly capacity exists to quickly satisfy rapidly rising local market demand for their products.

Many Case dealers are concerned about the difficulty in obtaining the Magnum nameplate two-wheel drive tractors from the factory. Case, meanwhile, is manufacturing 42 Magnums each day—the highest level of output in four years. Production schedules are expected to jump to 50 units in August or September.

According to them, momentum of the entire farm machinery business is in a state of rebound, moving toward a higher level of demand that's fueled by an across-the-board return to favorable economic fundamentals.

The combine business, in particular, is perched for a major rebound. Severe shortages of good, used combines on dealer lots are common. By this August, start of the fall harvest selling season, price margins will rise further as unit sales follow suit.

Much of the credit for rising machinery purchases is due to increased acreage planting of corn and soybeans.

This year's sales of combines in North America are forecast to advance by nearly 41%. Large four-wheel-drive tractors should increase by 25%. Row crop-type two-wheel-drives are seen climbing by a similar 25%. Dairy type (40-99 hp) tractor turnover should edge up by less than 1% and compact (below 40 hp) tractors are expected to fall by 4%.

Since higher-priced farm machines that are sold locally are built locally, dramatic turnaround in US agriculture will reap major dividends for US and Canadian makers of the vehicles.

Skepticism still persists among certain manufacturers that substantial rebound may not materialize. According to them, early 1989 sales statistics appear disappointing.

But other farm industry officials expect the widespread shift to favorable economic fundamentals will reward the business with a boom in demand starting in the fourth quarter.

"We are in the early stages of a significant turnaround," an official remarks. "We will soon reap a plentiful harvest. It's being planted now."■

US AND CANADA FARM MACHINERY SALES

	1988	1987	1986	1985	1984	1983
Below 40 hp	58,545	64,565	65,790	61,205	54,495	48,310
40 to 99 hp	42,435	39,865	40,195	46,315	46,935	44,925
100 hp +	18,455	18,455	17,715	22,555	29,090	33,775
All 4WDs	4,070	19,015	3,650	5,435	6,325	7,555
Total Tractors	**123,505**	**126,080**	**127,350**	**135,510**	**136,845**	**134,565**
SP Combines	7,190	8,715	10,470	11,250	14,220	16,680
Grand Total	**130,695**	**134,820**	**137,820**	**146,760**	**151,065**	**150,245**

CHILTON'S

AUTOMOTIVE INDUSTRIES

THE PEOPLE — THE PRODUCT — THE PROCESS

DESIGNING AROUND LIABILITY

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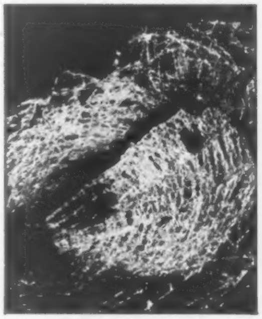

Unfortunately, the design engineer has become a pivotal figure in the storm of product liability claims hitting this industry. On page 32, we offer tips on how to design around potential lawsuits. Cover photo by Jay Asquini.

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Japan

Newcomer to the electronics field masters steep learning curve.

Nissan on-board navigation system on ARC-X concept car

Japanese companies have been making car electronics for just 25 years, and already they rank among the world's premiere products.

The industry, led by Nippondenso Co., Hitachi Ltd. and Mitsubishi Electric Corp., combined for sales last year in excess of 212.5 billion yen ($1.6 billion at the year average exchange rate). Including the total value of components sold, that number approached 3.838 trillion yen ($29.9 billion).

Driven by strong demand for sensors and electronic devices, GIS KK, a Tokyo-based industrial research organization, predicts that the market will reach 269.1 billion yen in 1990, nearly double 1985 levels. Industry analysts expect more than 10% yearly growth through the mid 1990s.

"The potential is unlimited," a senior Toyota Motor Corp. official declares. "And as the price of electronics continues to come down, we expect even greater usage."

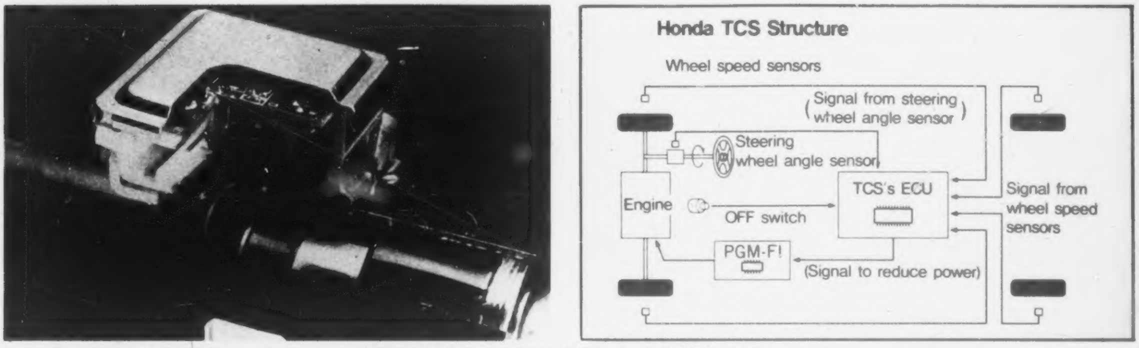
That potential, even today, includes such advanced features as head-up displays, traction control sytems, on-board navigation and car facsimilies. The near future will see the introduction of laser-warning devices, voice-activated controls and total vehicle control systems.

Nippondenso Co. president Taro Tanaka explains that unlike past years, when engine controls were the focal point of much of the industry's research activity, the future will see a greater emphasis placed on chassis development. All automakers, he says, currently are striving for improvement in suspension, brakes and steering, and wherever possible, they would like to integrate these into a single centrally controlled system.

One example of this trend is the introduction of a continuously variable transmission by Fuji Heavy Industries two years ago. The CVT, introduced on 1.0 L Subaru Justy model, is coupled with a computer controlled electromagnetic clutch, enabling the vehicle to adjust automatically both to changing road conditions and individual driving styles. Fuji, maker of Subaru cars, claims the system can achieve as much as 20% fuel savings.

Honda's recently introduced TCS (traction control system) is the world's first production system for front drive cars. It features wheel speed sensors and a steering angle sensor; its ECU incorporates road surface algorithms and calculates yaw rates.

This past May, Nissan Motor Co. may have taken this technology one step further with its announcement of the development of a new electronically-controlled four-wheel-drive system that incorporates a lateral acceleration sensor. The new system, five


Honda TCS Structure
Wheel speed sensors
(Signal from steering wheel angle sensor)
Steering wheel angle sensor
TCS's ECU
Engine
OFF switch
Signal from wheel speed sensors
PGM-FI
(Signal to reduce power)

Honda traction control schematic and TCS sensor.

years in development, helps improve cornering performance by controlling the torque split to the front axle according to the vehicle's operating conditions and road surface. Nissan will soon introduce the system into production.

While all Japanese automakers have relations with particular suppliers, none is closer than Toyota's with Nippondenso. During the 1980s, the two companies have collaborated in the development of electronic engine control, back sonar and optical fiber signal control, electronic suspension four-wheel anti-skid control and electronically controlled air suspension.

In 1987, Toyota introduced, with Nippondenso the industry's first car navigation system utilizing a CD-ROM disc. More recently, this past February, it began marketing a pair of car facsimilie machines for use in Japan. The units, including one model that can be strapped over the seat, are designed to handle A4-size transmissions. Developed jointly by Toyota, Nippondenso and Aisin Seiki Co., the facsimilies were built mainly for Toyota's top-line models such as the Crown, a car that utilizes 33 microcomputers. Toyota purchased 80 million semiconductors last year.

Needless to say, Toyota is not alone in making advances into the electronics field. Nissan, Mazda Motor Corp., Mitsubishi Motors Corp. and their suppliers all are investing heavily in research and product development.

Says Stephen Usher, and industry analyst for Kleinworth, Benson Internationl: "There's considerable pressure to bring products out that work. Car electronics is one of the areas that will determine the success or failure of new products—and companies."

To illustrate, in 1988 Nissan successfully commercialized the industry's first head-up display, featured on the 240SX. The system was developed jointly with an affiliate, Kanto Seiki Co.

Four-wheel-steering is another example. Again with Nissan leading the way, introducing the first electronically controlled 4WS in 1985, two other Japanese automakers since have followed with more elaborate systems.—Mazda and Mitsubishi Motors; Toyota is expected to follow suit later this year. And Nissan, responding to the competition, has just begun marketing a more advanced 4WS.

In the car navigation field, although Toyota is the only company to have marketed a CD-ROM system to date, other manufacturers, including Nissan, Mazda and Mitsubishi Motors, all have developed prototypes.

The Toyota system, featured on its 3.0 L Crown luxury sedan, is loaded with enough maps on its 540 megabit disc to cover all of Japan—more than 1460 in all, the smallest having been sealed at 1:75,000.

In the hardware area, one theme that holds considerable interest—and potential—is local area networking. To this end, Mazda this past March announced the development of a LAN protocol for automotive electrical systems. Based around hybrid IC and custom LSI, the Hiroshima-based automaker said it plans to incorporte the new system in its cars by the end of next year.

The protocol, which was developed jointly with Furukawa Electric Co., allows for multiplexing of wires and thus offers the potential to reduce space requirements for electrical equipment in cars in addition to weight. According to Mazda, just two wires can replace as many as 6000 that fit in conventional wire harnesses, in the process reducing the net diameter of the harness by an estimated 60%; weight reduction is expected to be 11 lb. (5 kg).

Mazda's however, is not the first practical multiplex wire system to be introduced by a Japanese automaker. That distinction belongs to Nissan, which two years ago commercialized a system utilizing a custom LSI. The Nissan LAN, currently is finding use for power windows, seats and door locks, has been installed in more than 300,000 cars since making its June 1987 debut on the Cedric Gloria.

The system, developed at Nissan's electronic research laboratory, is based on a customized LSI that features an advanced noise elimination circuit. Although developed inhouse, it is being manufactured by Hitachi Ltd., Nissan's major supplier of car electronics.

The complete system, including door locks, power windows and seats, is being assembled by Nissan affiliates Niles Parts and Kanto Seiki. Monthly production currently stands at about 30,000 units, incorporating roughly 120,000 LSIs.

To date, the most significant application has been for door lock and power window controls (particularly for switches mounted on the center pad of the steering wheel such as radio, air conditioning and auto speed controls) and for a compact on-board TV.

So big are the stakes in this emerging market that companies have started to set up special groups internally or to form joint ventures focusing solely on the car electronics field. Toshiba, is an example, last April established an automotive electronics systems office. Staffed by 20 engineers, the main function of the group is to coordinate automotive-related research activities within the organization and, where possible, to custom-design and manufacture components.

Toshiba, with long ties to Toyota and Nippondenso, already is the leading supplier of semiconductors to the Japanese auto industry. It now will seek to develop systems.

Research official Satoshi Negishi says one of the main target areas is the communications field including such areas as navigation, voice and data transmission and voice recognition. Japanese leader in both the development and production of telephone systems and equipment, Toshiba began R&D in voice recognition 16 years ago.

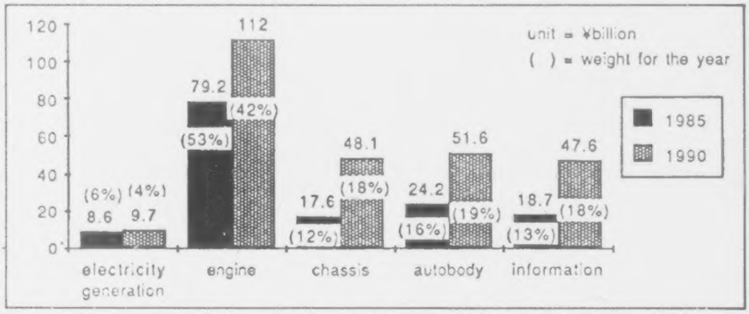
Using that as a base, it initially plans to turn its attention to auxiliary functions such as radio or stereo tuning, air-conditioning and temperature control and automatic window control. Longer term, it hopes to broaden these applications to include the basic operation of the car—driving, steering, and stopping and starting.

Likewise, Mazda and NEC have formed a joint venture, NALDEC Corp., to develop and manufacture advanced electronic components for automobiles. Production is scheduled to get under way this fall at a new 14.5 billion yen facility in the city of East Hiroshima. Mazda have indicated that the main focus of the operation, at least at the outset, will be on automotive control systems, including electronic control units for chassis and engines. All of the output is planned for use by the Mazda group.

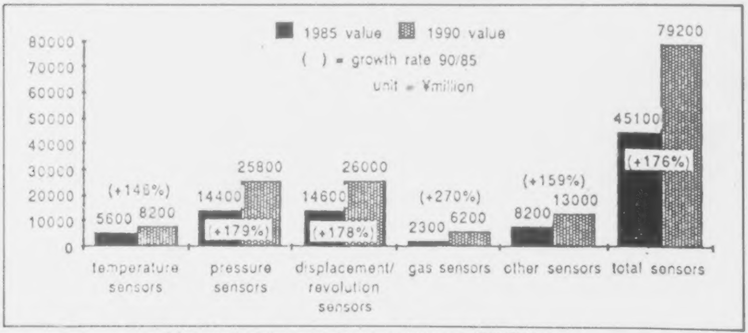
Mazda also has teamed up with Matsushita Electric Industrial Co., Japan's largest maker of consumer electronics, and Ford Motor Co. to produce car air conditioners. Japan Climate Systems Inc., a joint venture based in Hiroshima, currently is producing an estimated 100,000 car air-conditioners a year.

	1985	1990	growth 90/85
Electronic devices	61850	111830	181%
microcomputers	9670	20930	215%
ICs	4540	8100	178%
discrete semiconductors	15700	24800	158%
hybrid ICs	25600	42900	168%
displays	6340	15100	238%
Sensors	45100	79200	176%
temperature sensors	5600	8200	146%
pressure sensors	14400	25800	179%
displacement/revolution sensors	14600	26000	178%
gas sensors	2300	6200	270%
other sensors	8200	13000	159%
Passive parts	10860	19880	183%
coils and transformers	1200	2400	200%
capacitors	4840	8900	184%
resistors	2920	5080	174%
LCR compound parts	1900	3500	184%
Mechanical parts	20200	38600	191%
switches	13000	26400	203%
connectors	7200	12200	169%
Functional parts	10500	19600	187%
motors	9500	17400	183%
speakers and buzzers	300	800	267%
oscillators	700	1400	200%
GRAND TOTAL	148510	269110	181%

Analysis of Japan's automotive electronics market by devices and parts. (EGIS K.K.)



Japan auto electronics trends, by application. (EGIS K.K.)



Market trends according to part type. (EGIS K.K.)

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LEXUS

TOYOTA BLITZES THE LUXURY FRONT

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BETHESDA MD 20814

AUGUST 1989 VOLUME 169, No.8

CHILTON'S AUTOMOTIVE INDUSTRIES

SINCE 1895

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The Lexus LS400 luxury sedan is everything you'd expect from the best cars of Germany and Detroit and everything you'd expect from a Toyota—which should cause the boys in Munich, Dearborn, Stuttgart and Detroit to reach for the Maalox. Story on p.40.

Cover photo by Mike Gaspar.

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AUTOMAKER QUARTERLY REPORT

by Dr. THOMAS O'GRADY

The US automotive market is starting to show signs of change, as heavy competition from the increased number of manufacturers and products combines with sales slump.

Losses in both sales and market share are no longer defined by country of origin. Automakers from the US, Europe, Japan, and Korea are suffering. The biggest loser, Hyundai, was the biggest success story only two and three years ago. Customer perceptions, pricing, and the economy are all hurting Hyundai.

Among the Japanese, Mazda, Subaru and Isuzu are all losing share, while Honda, Toyota, Nissan, Daihatsu, Mitsubishi and Suzuki are gaining. Suzuki did not field a car model in 1988, and Daihatsu was still only in a startup mode.

Nissan's dramatic increase in sales seems particularly strong for a company which was sliding so rapidly. The change at Nissan was brought about by product, as some rather stodgy old carlines were replaced with good looking designs. Nissan's market share has increased from last year by approximately .5 percentage points as Nissan is hovering around 5% of total market share. It had dipped as low as 3.4% by the end of 1988 as the former products were being discontinued.

> *For second quarter 1989, four of the top 10 US market cars, based on units sold, are Japanese.*

Although still one of the smaller companies, Mitsubishi is on the verge of doubling its market share. Several new products with many industry awards, combined with some sharp sales-oriented advertising and the increased capacity at Diamond Star, is giving Mitsubishi a tremendous boost.

Honda and Toyota, the two perennial import leaders, are benefiting from increased capacity and the respective successes of the Civic and Camry. Honda has dramatically increased market share by approximately 1.2 percentage points since last year, while Toyota has increased by half a percentage point.

For second quarter 1989, four of the top 10 US market cars, based on units sold, are Japanese. Although the domestics saw rapid increases in Japanese prices after the 1987 stock market crash and subsequent fall of the dollar, the total market share for the domestics is already starting to fall (See *Newsline*, June '89 *AI*, p. 26). Ford is the only domestic with market share gains.

Dr. Thomas O'Grady is president and chief analyst of Integrated Automotive Resources, Inc. in Wayne, PA.

WHAT'S HOT! Domestic Auto Sales 2nd Quarter 1989

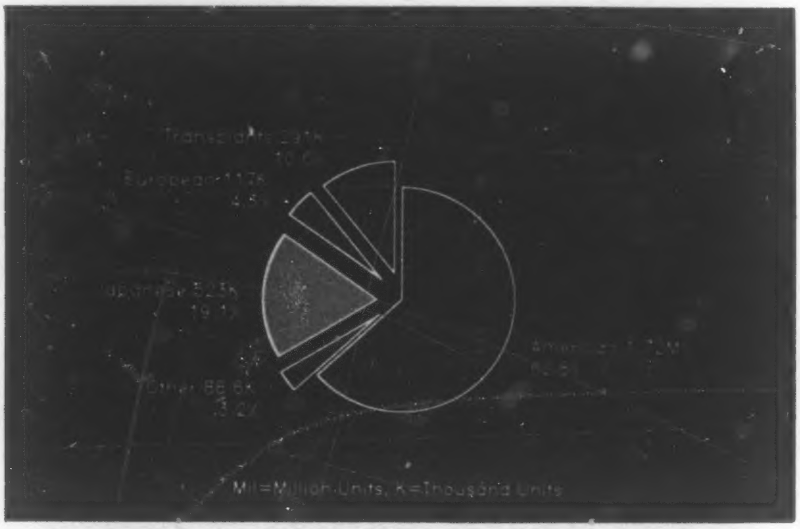
Carline	'89	'88	% Change
Corsica/ Beretta	112,461	121,394	(7.36%)
Taurus	102,165	109,072	(6.33%)
Accord*	94,127	94,606	(0.51%)
Escort	86,454	100,012	(13.55%)
Cavalier	81,794	85,508	(4.34%)
Camry*	75,622	56,182	34.60%
Civic*	68,019	42,798	58.93%
Tempo	59,651	74,838	(20.29%)
Celebrity	55,192	67,216	(17.89%)
Sentra*	53,599	66,789	(19.75%)

*—Includes imports;( )—Negative value

US Passenger Car Market Shares, 2nd Quarter, 1989

Manufacturer	Sales	% Total
General Motors	996,194	36.30%
Ford	611,724	22.29%
Chrysler	294,770	10.74%
Honda/Acura	216,472	7.89%
Toyota	176,509	6.43%
Nissan	135,865	4.95%
Mazda	58,986	2.15%
Hyundai	48,599	1.77%
VW/Audi	45,326	1.65%
Subaru	35,945	1.31%

(Continued p.66)



Passenger Car Market Share By Geographic Base

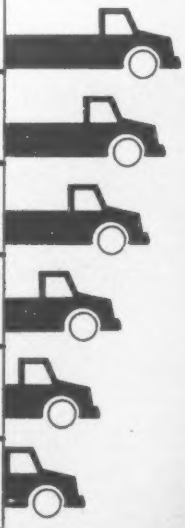
Second Quarter 1989

Manufacturers	Total Sales	Total Market Share
American	1,723,498	62.80%
Japanese	523,266	19.07%
European	117,487	4.28%
Transplants	291,574	10.62%
Other Imports	88,686	3.23%
Total	**2,744,511**	**100.00%**

2ND QUARTER 1989 DOMESTIC LIGHT TRUCK PRODUCTION

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL	
							2Q '89	2Q '88
FORD	197,443	89,091	64,938	62,244	19,066	33,803	468,585	434,365
CHEVROLET	155,177*	59,224	48,782	42,015	39,993	50,318	395,509	381,980
GMC	58,405*	14,927	18,452	11,540	11,896	14,004	129,224	114,164
CHRYSLER	26,357	26,315	25,975	127,824	—	—	206,471	212,378
JEEP	—	7,813	—	—	2,535	90,065	100,433	81,296
NISSAN	—	30,265	—	—	—	—	30,265	20,631

*Includes Suburban and P-model



Truckmakers Not Worried—Yet

by JOHN STARK

Falling interest rates may have rescued manufacturers of Class 8 trucks from souring market conditions, but their troubles aren't over.

Truckmakers are saddled with unfavorable business fundamentals, even though key money-lending institutions recently cut interest rates.

Producer prices are in a slump. Industrial output is off. Truck tons being hauled across the US have shrunk. Car sales and housing starts are still down. The economy has slowed considerably as consumers are no longer rushing to buy big-ticket items.

Trucking fleets, which haul goods to and from the marketplace, are following suit. They are canceling existing orders for new vehicles from the factories, ordering fewer overall trucks since last February.

Hence, the days' supply of backlogs of orders for new trucks from the factories continues to shrink. Truck assemblers hope to stretch out the days' supply by marginal cutbacks in vehicle production.

Many industry officials believe the recent reduction of interest rates will only forestall further slowdown in the truck business until the end of the third quarter '89. Weak economic conditions then are seen gaining the upper hand once more, fueling the start of another cyclical business downturn during the fourth quarter.

JOHN STARK is editor and publisher of Stark's Off-Highway Ledger.

Navistar International, Mack, Kenworth and Peterbilt are hedging their business forecasts by trimming daily truck assembly schedules. By reducing the actual amount of trucks they build each day—rather than halting plant output—they apparently hope recent 'soft' business isn't serious.

As a result, the mix of truck production cutbacks has so far been pretty evenly distributed between long-nose and COE-type heavy trucks.

Dealer truck stocks have risen and cancellation rates on gross incoming truck orders turned volatile for a month or two. Yet, the problems are being treated with an unchanged remedy—cutbacks in daily truck output.

It's a sure sign that truckmakers aren't too worried yet. US retail truck sales, after surging earlier this year, are expected by many officials to ease in the 1989 second half. Unit turnover is seen stalling this year at 148,000 vehicles and contracting next year by 10% to 15%.

The forecasted margin of 1990 downturn suggests truck sales will fluctuate in a narrow band during the next two to three years. It makes for an outlook of stagnant local market demand—albeit at a higher base than during previous cyclical downturns and growing export business. Cash flow should remain buoyant, easing pressure off reducing investment into expanded plant capacity.

Heavy truck manufacturers are capable of assembling 171,800 units each year at 17 assembly plants in North America—an 8% and 11.5% reduction from 1987 and 1986, respectively. By the end of 1990, production capacity should climb by 5%, as newer assembly facilities are opened by Kenworth and Freightliner.■

US CLASS 8 TRUCK BUSINESS

	1988	1987	1986	1985	1984
Production	135,800	125,850	101,300	121,900	155,600
Retail Sales	148,361	131,156	114,095	133,583	137,785
Inventories (year end)	20,750	18,639	15,785	19,668	25,950
Net Orders	181,100	165,850	142,000	118,350	n/a
Backlogs (year end)	60,000	55,85[illegible]	46,600	35,800	55,300

TOP 5 US CLASS 8 TRUCKMAKERS, BY SALES

	1988	1987	1986	1985	1984
International	33,808	28,914	28,303	28,523	31,677
Freightliner	24,164	23,350	17,473	18,054	17,597
Mack	21,846	18,268	17,247	23,696	23,632
Volvo GM	17,089	10,840	11,361	11,773	9502
Kenworth	16,700	14,018	10,457	11,830	13,462

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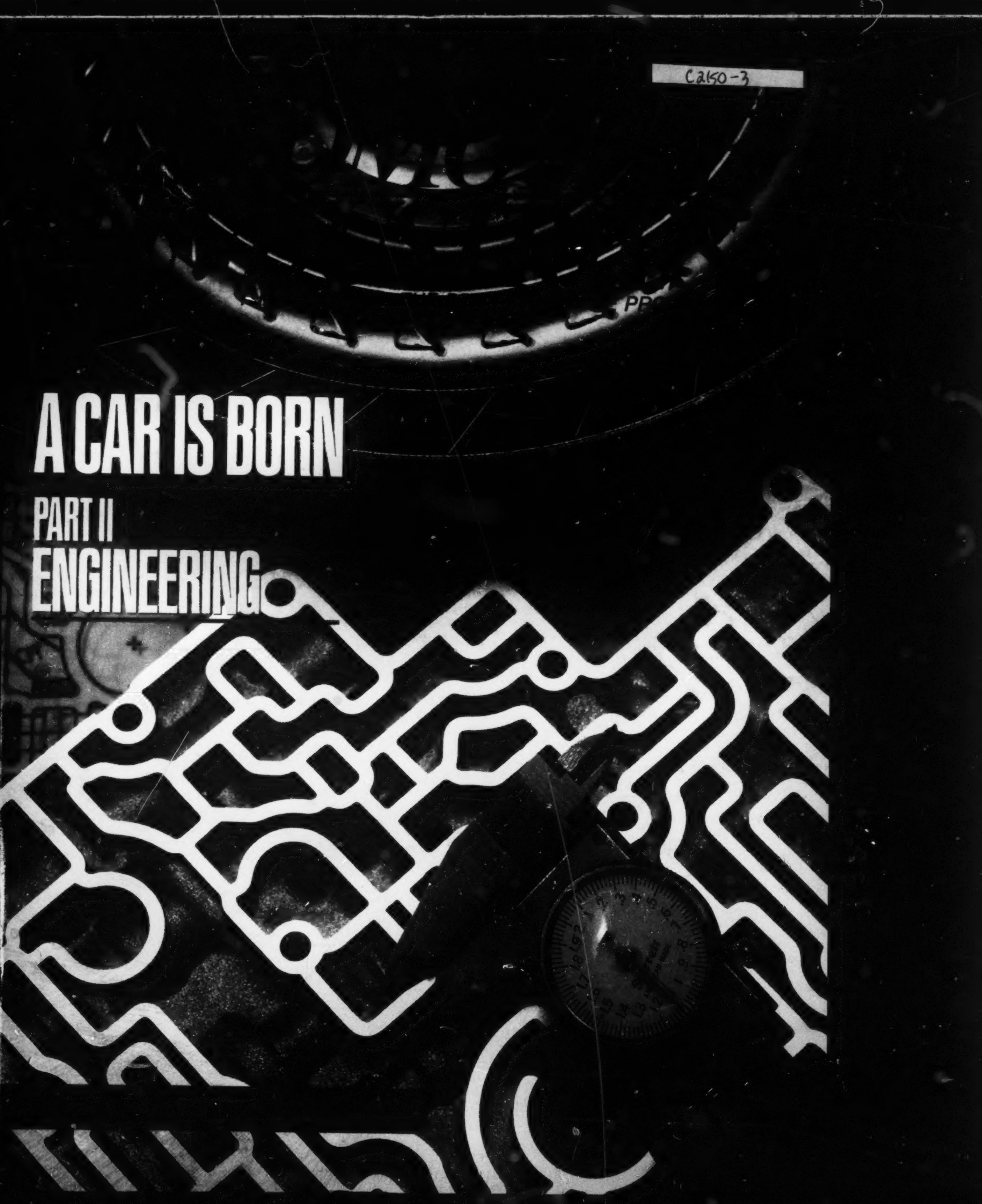


A CAR IS BORN

PART II

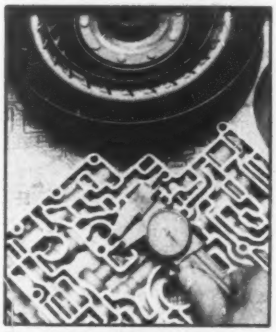
ENGINEERING

SEPTEMBER 1989 VOLUME 169, No.9

CHILTON'S AUTOMOTIVE INDUSTRIES

COVER STORY

42 A CAR IS BORN, PART II: ENGINEERING
Tracing the state of the art in carmaking.



Our cover story picks up where the March '89 issue left off--namely, at the beginning of the engineering process. With Part II of 'A Car Is Born,' Gerry Kobe takes you through the state of the art in automobile engineering. Story on p.42.

Cover photo by Jay Asquini
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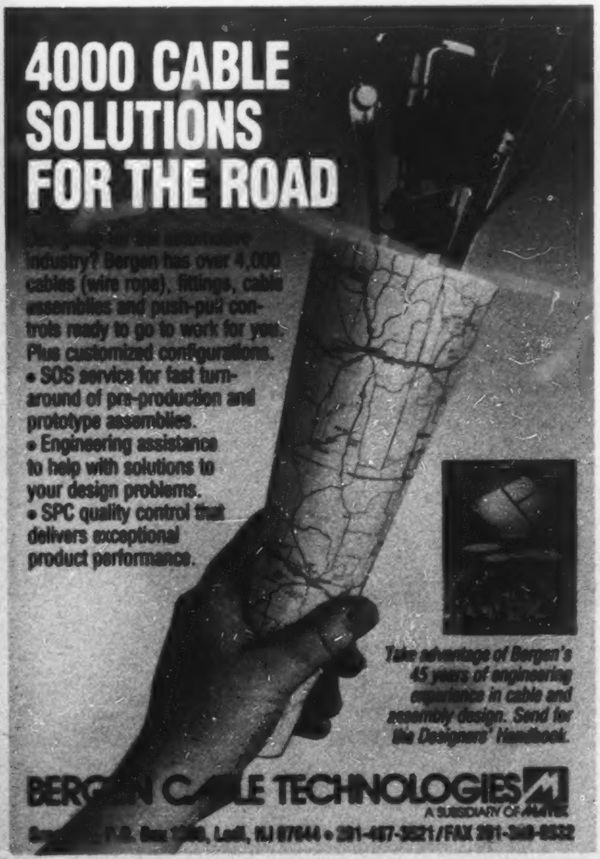
Japanese Market Runs Strong

JAPAN AUTOMOTIVE SALES: JAN. TO JUNE, 1989

COMPANY	TOTAL	VS '88	CARS	TRUCK	SHARE
Toyota	1,123,778	+ 4.8%	850,244	273,534	31.5%
Nissan	655,070	+ 12.7%	485,871	169,199	18.3%
Mitsubishi	331,111	+ 5.2%	99,637	231,474	9.3%
Honda	23,124	+ 8.4%	213,255	109,869	9.0%
Daihatsu	268,267	- 1.6%	68,141	200,126	7.5%
Suzuki	266,639	+ 0.3%	53,999	212,640	7.5%
Mazda	217,884	+ 7.5%	128,223	89,661	6.1%
Fuji	150,598	- 7.9%	60,565	90,033	4.2%
Imports	81,251	+ 37.7%	80,789	462	2.3%
Hino	31,327	+ 12.5%	--	31,327	0.9%
Niss.Diesel	18,742	+ 14.4%	--	18,742	0.5%
TOTAL	3,572,188	+ 5.7%	2,063,915	1,508,273	100.0%

Source: Toyota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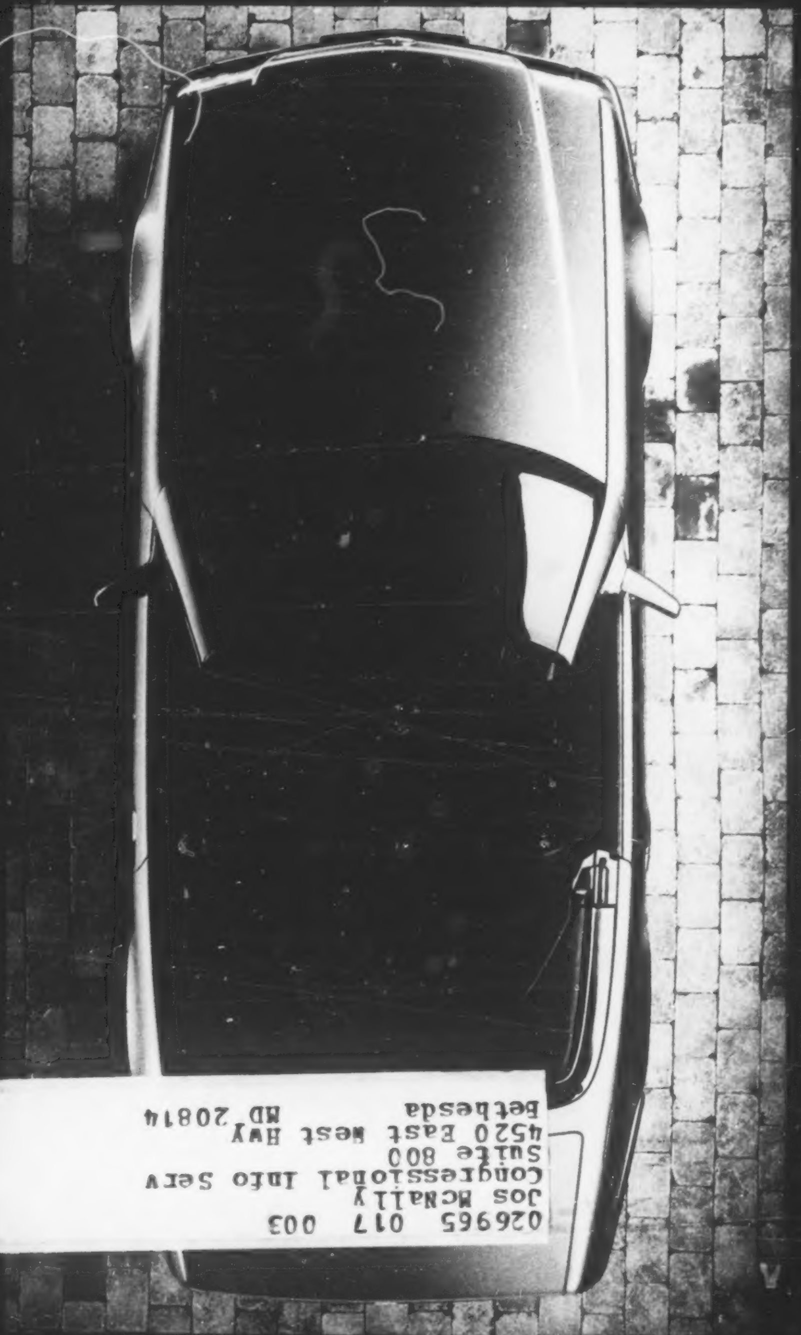

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OCTOBER 1989 VOLUME 169, No.10

AUTOMOTIVE INDUSTRIES

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Our annual New Cars issue,
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COVER STORY

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M-B's no-compromise Coupe de Grace

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Analyzing Dealer Inventories

RAY WINDECKER's 45 years in the industry culminated at Ford, where he was research and analysis manager, public affairs. He now runs American Autodatum, an 'automotive numbers and words' company.

Misreading days' supply data can cause damage to the automotive community and the economy at large.

Of all the statistical barometers in the auto industry, dealer inventories are probably the most used – and abused.

For example, the auto manufacturers often use the term "dealer" inventory as a description of units at the dealership. But when the media describes the dealer inventory, it includes units at the factory gates, at railroads, on trains and on trucks.

When the media says a manufacturer has a "75-day supply of vehicles," the factory people are describing the identical data as 65 days at the dealerships and 75 days inventory.

Moreover, there are differences in the way inventories are reported by the domestic manufacturers and the importers.

In recent years, Honda and Toyota were able to brag that they only had an eight-to-10 days' supply of cars at their dealers.

But consider that it logically takes a day or two to move the car off the boat, through the dockside paperwork and marshalling yard, and another day or two for the dealer to receive the car, prep for delivery, notify the customer that the car is available, do the retail paperwork and finally deliver the car. That meant there would be only four to six days transit time to the dealer, and that the dealer would have no inventory – except for those units in the process of delivery.

Obviously, this was not realistic inventory reporting. Though most companies remain reluctant to disclose their inventory counting and reporting procedures, at least one Japanese manufacturer is using a more equitable counting of its dealer inventories of units produced in the US and Japan.

And wouldn't it seem even more equitable to view units at sea as part of the total production process, and units on the dock as part of the distribution system, in the same manner that domestic units are counted as inventory when they leave the factory?

Considering that many importers are now reported to be holding unusually high portside and inland inventories, comparisons to domestic data may be understated.

They probably do it this way because reporting low inventories can be a psychological benefit – measurements of successful management and overall product acceptance!

Another aspect of dealer inventories is the seasonal nature of the business. Automotive plants build cars at a fixed rate per hour, both winter and summer, but people tend to buy *more* cars in the spring and *fewer* in the winter. The seasonal nature of sales has been accepted for many years by most analysts and automotive organizations. Yet, it's been ignored by everyone else.

Since domestic car inventories are the ones most often scrutinized and discussed, let's use them as the statistical base in this example of seasonality. During the strong 1985-1988 years, the domestic Big Three averaged 68 days' supply of domestic cars, not the 60 days "norm" that is often quoted.

The seasonal pattern becomes apparent if you simply write down the statistics. The four-year average for the January-end days' supply of the Big Three was 87 days. Only August met the mythical "normal" 60 days level. As shown on the chart, the seasonal range for Big Three inventory days' supply run from 60 to 65 days in the spring and summer to 85 to 90 days in January.

The damage that can be done to the automotive community and the economy at large by misreading this data was painfully apparent this past February. January inventories were quite normal. The Big Three dealers held an 88-day supply of domestic cars at the dealerships and in transit, certainly not a point of more than watchful caution on the part of industry production planners. One company was at 95 days, a concern for that particular company, yet the total Big Three days' supply was within the January range.

Unfortunately, the normal 88 days' supply was seen as excessive against the "60-day norm" and was described as a situation of great concern by one or two analysts who were widely quoted in the consumer media. Buyers were advised to delay their purchases and wait for larger rebates that would be necessitated by the "excessive" inventory.

The fact that the inventory levels were not excessive for the end of January was not understood or was ignored. And while there was virtually unanimous agreement within the analytic community that 1989 sales would trail those of 1988, there's no doubt that sales were reduced by the doomsayers.

There is also the question of inventory volumes and their importance relative to days' supply. Days' supply is a more useful analytic tool than volumes, as it's the product of both inventory units and sales. The days' supply calculation is quite straightforward – month-end unit inventories are divided by the month's daily selling rate. Thus, days' supply is a measure of the travel-rate of sales against the unit inventory.

Inventory units, while less of an analytic tool, are an expense to the dealer, since he most often has to finance them. For example, a car with a $10,000 invoice at 10% interest rate will cost a dealer $83.33 a month in carrying charges.

At the end of the 90 days, the dealer has $250 interest money invested in the car, less whatever help he receives from his factory, an amount that can range from nothing to substantial, depending on the manufacturer. The end result is that slow-turn merchandise is a problem. Yet it is also true that days' supply, not inventory, is the measure of slow turnover.

One point about inventories that is often misunderstood is that record unit inventories, when they invariably happen, are a direct result of a long-term expansion of industry sales. In much the same way that the sales trend moves upward over the years, pushed up by population and employment growth to create record sales years, it is logical that inventories will follow to service the sales. Not necessarily in lock step, but record sales and record inventories are intertwined.

BIG THREE DAYS' SUPPLY
Month End Seasonal Range*

January	85-90 days
February	70-75
March	60-65
April	60-65
May	60-65
June	60-65
July	60-65
August	60-65
September	60-65
October	70-75
November	70-75
December	70-75
AVERAGE	65-70 DAYS

Data Base: Jan. 1985-June 1989
*Cars

The oddity is that record sales are generally admired, while record unit inventories are considered by many to be negative, even though both are fueled by the same population and job-holder growth patterns.

Overall, when discussing inventories, it is best to remember that days' supply is considered more important analytically than are units, that there is a seasonal factor, and that unit inventories will at some time in the future be at record levels, as will sales, as both sales and inventories are intertwined.

Only this is certain – the 80-day domestic car inventories of the summer of 1989 were above the 60- to 65-day norms for that time of year, but were substantially and mercifully below the 110-day record of December, 1981. AI

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